Managing Knowledge in IT-based Innovation: The Case of Business-to-Business Electronic Commerce Implementation

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Thesis submitted for Degree of
Doctor of Philosophy in Industrial and Business Studies

University of Warwick
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August 2002

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Acknowledgements

I would like to take this opportunity to thank all those who have made a contribution to this thesis. While being an individual effort, in many ways their help and support throughout the past four years made this thesis possible.

Jacky Swan and Bob Galliers, my supervisors, have guided this research project into an interesting research domain and have provided much thoughtful advice and encouragement. Thank you for bearing with me and helping me see it through to the end.

Other members of the Warwick Business School have been generous in their support and advice. Maxine Robertson, Margi Levy and Lars Mathiassen helped make many apparently difficult academic problems solvable.

Research of this type relies heavily on the quality of the case studies available. I have been very fortunate to meet wonderful people at ComCo and AutoCo who supported the project with time, thought and their openness. Many of the ideas expressed between these pages grew from their considerations.

This research would not have been possible without financial support. The Economic and Social Research Council and the Warwick Business School provided the basic funding. Also, thanks to the Warwick Business School Information Systems Support Unit and Distant Learning MBA team for letting me work on some great jobs.

On a personal note I would like to express my appreciation to my family and friends for their perseverance and support over such a long and demanding period. My parents, Waltraud and Joachim Tribiahn, have shown great love and confidence. Thanks also to my Aunt Helga and my late Uncle Bernd Brockmann for their care and encouragement.

Finally, this thesis would not have been possible without the unwavering love and emotional support of Maitesita Wilson.

Summary

This thesis is concerned with understanding the way in which knowledge is managed in IT-based innovations. Although there is a growing body of research on how to leverage knowledge to improve organisational performance, particularly in the field of "knowledge management", most studies divorce knowledge from its context and fail to consider the purpose for which knowledge is managed. One such purpose is the integration of IT-based innovations, during which knowledge about complex IT is integrated with context-specific organisational knowledge, in order to develop firm-specific solutions. However, existing research in IS implementation and IT-based innovation tends to be fragmented and falls short of providing a comprehensive analytical framework for understanding the management of knowledge in IT-based innovations.

An analytical framework based on the processes of knowledge creation, sharing and retention is developed by reviewing literature in the area of knowledge management, IS implementation, IT-based innovation and organisational knowledge. As this research adopts a constructivist view of IT and knowledge, an interpretive case study approach was selected for the empirical investigation. The implementation of B2B e-commerce was selected, as it has been commonly described as knowledge-intensive. This research provides both a chronological and thematic description guided by the analytical framework of the integration of B2B e-commerce at ComCo and AutoCo, two large original equipment manufacturers in the vehicle manufacturing sector.

One major contribution of this research is the development of an analytical framework that focuses specifically on understanding the management of knowledge in the integration of IT-based innovations. The analysis has revealed the existence of "knowledge phases" – periods of time in which the relationship between knowledge creation, sharing and retention is based on a stable pattern of organisational activities in order to serve a specific purpose. The research demonstrates the discontinuous nature of knowledge processes and IT-based innovations and highlights the negative side of communities of practice and social networks for knowledge sharing. Another contribution lies in showing the interrelation of the notions of "management as control" and "management as drift", frequently found in the discussion about the manageability of IT-based innovations. Rather than seeing these notions as exclusive and dualistic, they can both be understood as concurrently contributing to the management of knowledge in IT-based innovations.

Abbreviations

B2B	Business-to-business
B2C	Business-to-customer
BPR	Business process re-engineering
CIPS	Chartered Institute for Purchasing and Supply
CRM	Customer relationship management
EAME	Europe, Africa and Middle East
e-Commerce	Electronic commerce
EDI	Electronic data interchange
ERP	Enterprise resource planning
ESRC	Economic and Social Research Council
ICT	Information and communication technology
IS	Information systems
IT	Information technology
CC	ComCo
MIS	Management information systems
MRP	Manufacturing resource planning
OECD	Organisation for Economic Cooperation and Development
OEM	Original equipment manufacturer
OLQ	Online quoting
PAG	Premier Auto Group
UK	United Kingdom
US	United States

1. Introduction

1.1 Introduction

It has become increasingly difficult to miss the growing interest by practitioners and academic researchers alike in knowledge management. Knowledge management has been defined broadly as any processes and practices concerned with the creation, acquisition, capture, sharing and use of skills and expertise, in order to maintain or improve organisational performance (Quintas et al., 1996; Pan and Scarbrough, 1999). Interest in knowledge management can be traced back to Drucker (1969) and Bell (1973), who described the transition from an industrial economy that emphasised traditional economic resources such as land, labour and financial capital, to a knowledge economy based on advanced information technology (IT) and knowledge workers. One key assumption underpinning the interest in knowledge management is that knowledge is central to a firm's capacity to innovate and is the primary source of competitive advantage (Grant, 1996b; Earl, 1999). "Knowledge", variously defined, is perceived to be the most important resource in organisations and a key differentiating factor for business (Davenport and Prusak, 1998). This field of research suggests that effective management of knowledge is crucial for successful innovation.

Proponents of knowledge management are well aware of its faddish nature, but argue that it will establish itself as a new aspect of management and organisation (Hull, 2000). However, knowledge management is an under-theorised concept that suffers from a number of contradictions and inconsistencies (Alvesson and Kärreman, 2001). The vast majority of academic work on the subject tends to portray knowledge as a true, verified and functional resource at the disposal of rational management (Spender, 1998). This perspective is based on the widespread notion of knowledge as "justified true belief" (Nonaka, 1994) – a notion which is strongly contested by constructivist philosophy,

emphasising the existence of multiple constructions of reality (Berger and Luckmann, 1967). In addition, much of the work into knowledge management fails to consider the purpose for which knowledge is managed. Knowledge tends to be divorced from its context and depicted as an objectified entity that is of equal benefit in a variety of different contexts in the form of lessons learned and best practice (Alvesson and Kärreman, 2001). There is a need for research that takes into account the *purpose* for which knowledge is managed, e.g. facilitating innovation, in order to enhance our understanding of the management of knowledge in organisations.

One such purpose is the implementation of information systems (IS), which can be defined as "an organisational effort to diffuse an appropriate information technology within a user community" (Kwon and Zmud, 1987, p.231) and can also be described as a technological (Kwon and Zmud, 1987) or IT-based innovation (Scarbrough, 1998). Traditionally, research dealing with the issue of knowledge tended to reflect the fragmented state of IS implementation and innovation research (Myers, 1994a; Galliers and Swan, 1999). Knowledge in IT-based innovations has been addressed, for example, as part of the acquisition of technical knowledge (Scarbrough, 1995), development of technological frames (Orlikowski and Gash, 1994), or IS experts (Currie and Glover, 1999). More recently, studies have placed knowledge centre stage in the analysis of IT diffusion (Newell et al., 2000) and implementation (Huang et al., 2001). Such studies conceptualise the implementation as an IT-based innovation, during which knowledge about complex IT is integrated with localised, context-specific organisational knowledge, in order to develop firm-specific solutions (Clark and Staunton, 1989; Fleck, 1994). However, existing research tends to be fragmented and falls short of providing a coherent analytical concept of how knowledge is managed in IT-based innovations, albeit recognising its significance.

One type of IT-based innovation that has received increased attention in recent years is the integration of Internet-based IT, commonly referred to as electronic commerce

(e-commerce). In particular, business-to-business (B2B) e-commerce, which enables the electronic exchange of money, goods, services and information between businesses via the Internet (OECD, 1999a) has been depicted as a knowledge-intensive innovation (Earl, 1999; Kalakota and Whinston, 1996). It has been suggested that the integration of B2B e-commerce offers a considerable challenge to organisations in terms of the acquisition and integration of new technical and organisational knowledge (Timmers, 1999; Chatterjee et al., 2002). In addition, the integration of B2B e-commerce requires the combination of cross-functional expertise, as it affects not only the existing IT infrastructure, but also business processes that cut across organisational functions (Turban et al., 2000; May, 2000). It follows, then, that a key to the successful integration of B2B e-commerce is based on the effective management of knowledge, whether it is explicitly labelled as "knowledge management" or an implicit part of organising implementation activities (Swan et al., 1999). Therefore, B2B e-commerce appears to offer an opportunity to research how knowledge is managed during the integration of IT-based innovations.

The *manageability* of knowledge is one key assumption in the field of knowledge management (Stewart et al., 2000). There is the common belief that information and communication technology (ICT) such as "knowledge management systems" play a dominant role in storing, searching and transferring knowledge within and across organisations (Grover and Davenport, 2001). While research tends to explore the notion of knowledge at least to some extent, the notion of management is typically portrayed as something self-evident (e.g. Hansen et al., 1999) or, more commonly, unexplained (e.g. Cook and Brown, 1999; Lam, 2000). In terms of management, knowledge tends to be perceived as an organisational resource that can be planned, organised and controlled by managers (Davenport and Prusak, 1998). However, in their review of the manageability of knowledge, Alvesson and Kärreman (2001) argue that knowledge is an ambiguous, unspecific and dynamic phenomenon, intrinsically related to meaning, understanding and

process, and therefore difficult to manage. There is an absence of empirical research addressing the question of how knowledge is managed, particularly in purposeful activities such as the integration of IT-based innovations.

Galliers (1999) argues that useful insights can be developed from an integrative approach that links the topics of e-commerce and knowledge management. Research in this domain, which is the remit of this study, will provide an additional perspective on IS implementation. This follows Myers' (1994b) call for the creation of broad perspectives that provide an overarching framework within which IS implementation research can proceed. In doing so, this research will pull together separate areas of existing research and integrate them into a coherent analytical perspective of IS implementation, with a focus on the management of knowledge. This research also makes a contribution to the field of knowledge management by introducing a purpose for the management of knowledge, e.g. the implementation of IT in an organisational context. By conducting empirical research into the integration of B2B e-commerce, this research contributes to our practical understanding of how organisations implement and use B2B e-commerce.

1.2 Research Aim, Questions and Objectives

The aim of this research is to develop and utilise an analytical framework to understand how firms manage knowledge, where the purpose is to integrate IT-based innovations within an organisational context over time.

The specific research questions are:

- How can the nature and role of knowledge be conceptualised in IT-based innovations?

- How is knowledge being managed in IT-based innovations?

Objectives of the research project are to:

- Review research literature in the area of knowledge management, IS implementation, IT-based innovation and organisational knowledge, in order to establish what is presently known about the management of knowledge in IT-based innovations.

- Develop an analytical framework grounded in the literature, that is capable of guiding and supporting the empirical research presented here.

- Identify an appropriate research methodology that reflects the notion of knowledge adopted by this research.

- Describe and analyse, specifically in relation to knowledge, the integration of B2B e-commerce in two case companies by utilising the analytical framework.

- Refine the analytical framework based on this empirical study and reflect on its analytical value for our understanding of the management of knowledge in IT-based innovations.

1.3 Scope

The research focuses on the role and nature of knowledge and how it can be managed in IT-based innovations. This specific focus defines the scope of this research, which is outlined in more detail here. Due the lack of substantive existing research, this research is of an exploratory nature, with the objective of understanding rather than prescribing how knowledge is managed in IT-based innovations over time. A compromise had to be made in terms of the breadth and depth of literature on which this research draws. It is not within the scope of this research to address in depth all relevant issues concerning the management of knowledge in IT-based innovations. Rather, the research draws on a wide range of existing studies, in order to understand the innovation process on a more integrative and analytical level.

This research focuses on the management of knowledge within the context of IT-based innovations, specifically B2B e-commerce. This will ensure that the findings are particularly relevant for innovations that are based on IT. No attempt is made to analyse the management of knowledge for organisational innovations that are not predominantly based on the implementation of IT, e.g. product and service innovations.

The unit of analysis is the activity of implementing B2B e-commerce, in order to understand specifically the management of knowledge during the *integration* of IT-based innovation. It is not within the scope of this research to analyse any other activities related to managing knowledge, except where they relate to the integration of B2B e-commerce.

Generally, e-commerce applications differ in terms of purpose, functionality and the external organisations or customers using them. This research focuses on the area of B2B e-commerce because it is knowledge-intensive and estimated to be the most important form of e-commerce (Timmers, 1999). It is not within the scope of this research to study other areas of e-commerce such as business-to-customer (B2C) e-commerce, except where they are relevant to understanding the integration of B2B e-commerce.

This research analyses the social aspects of the integration of B2B e-commerce, as knowledge and its management is intrinsic to human interaction. No attempt is made to detail the technological aspects, such as specific hardware, software or programming languages used to build B2B e-commerce applications. Technological issues are considered only where they have an influence on the social aspects.

The analysis focuses on activities related to the management of knowledge *within* the case company to ensure that the research concentrates on the organisational implementation rather than on the diffusion of IT-based innovation. It includes any relevant relationships and interaction with external organisations such as sister organisations, suppliers, and

consultants. It is not within the scope of this research to detail the management of knowledge in external organisations in relation to their integration of B2B e-commerce, other than those with direct relevance for the case companies.

To explore the management of knowledge during the integration of IT-based innovations, it is necessary first to understand what is meant by the terms "knowledge" and "management". The definition of knowledge and management is a complex topic and it is not within the scope of this research to attempt to develop new definitions. After critically reviewing associated fields, assumptions are made and definitions declared, upon which this research is based.

Topic analysis and a desk survey led to the selection of case companies in the vehicle manufacturing sector, as these were perceived to be one of the leading adopters of B2B e-commerce. No attempt has been made to make the case study sample representative of organisations in the industry. Instead, the case companies were selected because they intended to conduct major B2B e-commerce initiatives that would yield rich insight into how knowledge was managed in IT-based innovations.

1.4 Assumptions

The discussion of a complex topic such as the management of knowledge required making assumptions that subsequently influenced the type of literature reviewed and the methodological approach taken.

In this research, the management of knowledge is not necessarily seen as a formal managerial activity that explicitly focuses on controlling and planning knowledge per se, as the majority of knowledge management literature suggests (e.g. Nonaka, 1994; Grover and Davenport, 2001). Instead, this research assumes that knowledge is predominantly "managed" implicitly as an integral part of organisational activities to perform tasks (Blackler, 1995). Knowledge is managed in the sense that it is unconsciously organised

and coordinated by organisational members as part of their interaction to perform their jobs, which is often beyond explicit managerial control (Alvesson and Kärreman, 2001).

Knowledge is defined as an interpretation of socially constructed realities that are situated in time and context and therefore subject to continuous revision and change (Berger and Luckmann, 1967; Guba and Lincoln, 1994; Blackler, 1995). This research makes a paradigmatic choice in so far as it adopts an interpretive ontological position. It is further acknowledged that the nature of the phenomenon under investigation has a high degree of inherent complexity and ambiguity, as knowledge is multifaceted and contested (Lave, 1993). The point has been made by a series of researchers that the positivist approach is unable to reflect the high complexity and ambiguity required to investigate meaning systems (Daft and Wiginton, 1979; Benbasat et al., 1987; Orlikowski and Baroudi, 1991; Walsham, 1995). Hence, conducting the research in the interpretive paradigm appeared to be the appropriate choice for this research.

It is, however, acknowledged that there are different valid definitions about knowledge, each based on different ontological and epistemological assumptions. Different definitions of knowledge are likely to require different methodological approaches to investigate the phenomenon. As a consequence, this research does not claim to present the only or best perspective on the management of knowledge in IT-based innovations, but one rigorous and complete version of it.

1.5 Structure

The following chapter reviews relevant literature in the area of knowledge management, IS implementation, IT-based innovation and organisational knowledge, in order to develop an understanding of how knowledge can be conceptualised and managed in the context of IT-based innovations. An analytical framework based on processes of knowledge creation, sharing and retention is proposed that will guide and support the empirical research.

Chapter 3 presents the methodological approach adopted in the empirical research. The argument is made for using an interpretive case study method to explore the phenomenon. The selection of two case companies, ComCo and AutoCo Cars, is justified, and data collection and analysis is outlined in detail.

In chapters 4 and 5, a detailed chronological description of the integration of B2B e-commerce at ComCo and AutoCo Cars is presented. The analytical framework is used to provide a thematic account of how knowledge was managed during the innovation process.

Chapter 6 analyses the findings in the light of the existing literature. Findings regarding the three processes of knowledge creation, sharing and retention are outlined, and their interrelation discussed. Findings regarding the expansion of the analytical framework and a more refined understanding of the management of knowledge in IT-based innovations are examined.

In chapter 7, the findings and the contributions of this research are outlined. Limitations and opportunities for future research are highlighted.

2. Literature and Theory

2.1 Introduction

The objective of the literature review is to draw on existing literature on knowledge management, IS implementation, IT-based innovation and organisational knowledge to analyse how knowledge is managed during IT-based innovations. The literature review, as depicted in Figure 2.1, takes four steps to achieve this objective. In the first step, the conceptual background is introduced by defining IT, knowledge and B2B e-commerce. The argument is made that B2B e-commerce presents an opportunity to research knowledge in IT-based innovations. In the second step, a framework for the analysis of knowledge in IT-based innovations is developed by drawing on research on knowledge processes and innovation episodes. In the third step, the manageability of knowledge processes and IT-based innovations is outlined and discussed with reference to power. In the fourth step, relevant bodies of literature related to the three major knowledge processes of creation, sharing and retention in the context of IT-based innovations are reviewed in more detail. The literature review concludes by summarising the main findings.

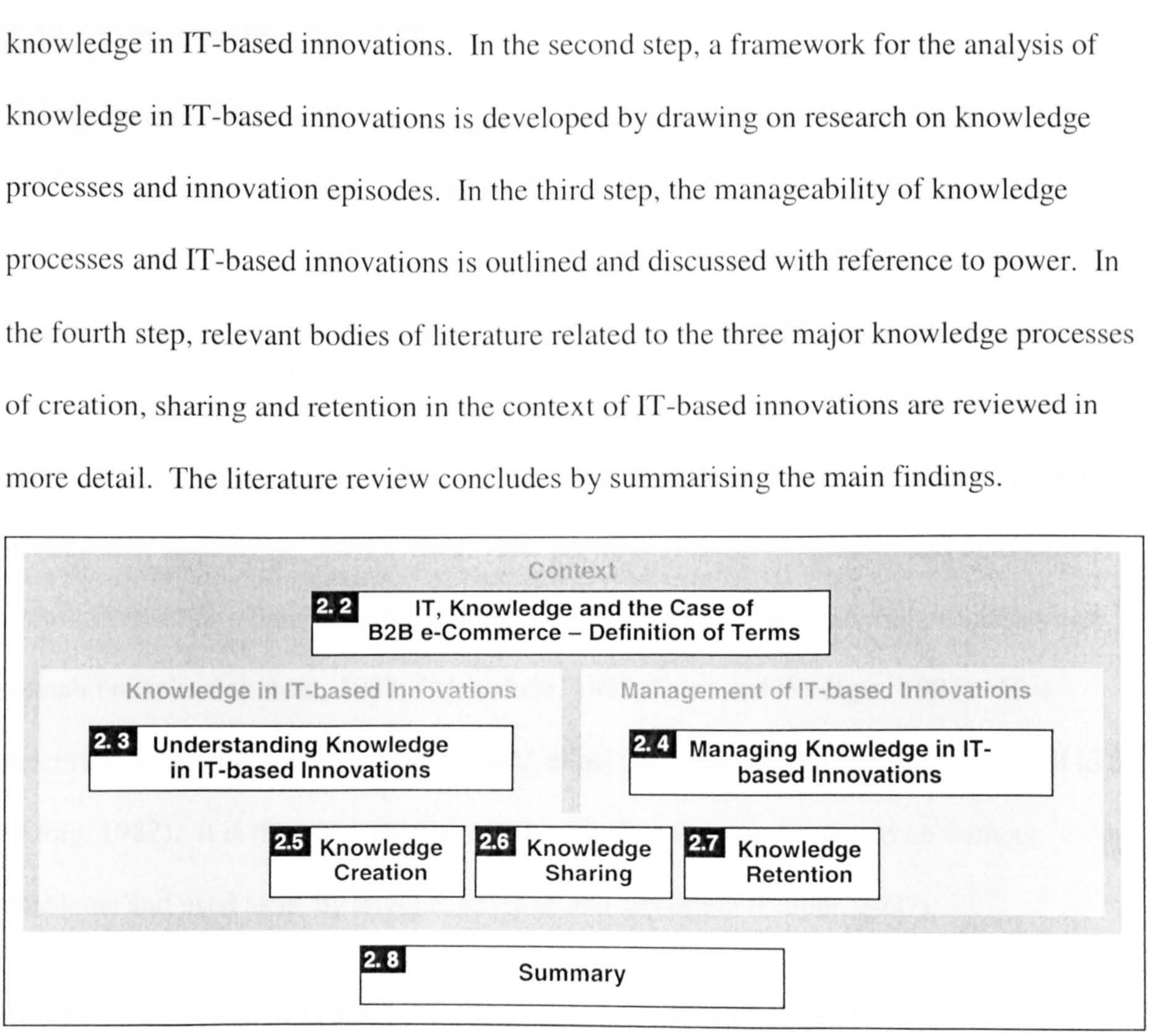


Figure 2.1: Structure of the Literature and Theory Chapter

2.2 IT, Knowledge and the Case of B2B e-Commerce – Definition of Terms

This sections aims to define the concepts of IT, knowledge and B2B e-commerce, to lay the foundation for the research on the management of knowledge in IT-based innovations. To start with, contrasting views on the characteristics of IT are discussed and the position of this research on the notion of IT is defined. Then, two opposing notions of knowledge are presented and the view of knowledge in organisations for this research is defined. This is followed by a short introduction to B2B e-commerce. Finally, reasons are given to support the argument that B2B e-commerce is particularly suitable for researching knowledge in IT-based innovations.

2.2.1 Conceptualisations of IT

Before defining B2B e-commerce in greater detail, it is necessary to specify the fundamental concept of IT as adopted by this research. Orlikowski and Iacono (2001) argue that although the field of IS is premised on the centrality of IT, the majority of research fails to engage in its core subject matter. As a result, IS research tends to draw on a commonplace and received notion of technology that conceptualises IT as a relatively stable, discrete technical entity, having little or no interdependence with a social context (Orlikowski and Iacono, 2001). Such view portrays IT as an exogenous and autonomous monolith that has a deterministic, unidirectional impact on organisational properties and human behaviour (Latour, 1987; Orlikowski, 1992; Grint and Woolgar, 1997). IT is perceived as an engineered artefact or tool, expected to do what its designers intend it to do (Kling, 1987). It is therefore seen as a stable artefact that can be passed on without problems and used as is, by anyone, anytime and anywhere (Latour, 1987).

This received notion of IT has been strongly criticised (Markus and Robey, 1988; Orlikowski and Iacono, 2001). Different suggestions are made to offer alternative notions of IT, in order to overcome the perceived shortcomings of an overly narrow view of technology in the IS field (Kling and Scacchi, 1982; Markus and Robey, 1988). For this

research, IT is understood to embody a complex, multifaceted bundle of ideas regarding, both the application of IT artefacts, and the organisation of social relations and processes that provide the social context in which people use it (Clark and Staunton, 1989; MacKenzie and Wajcman, 1985). Contradicting the notion of being monolithic, IT can be conceptualised as a "web of computing" that links equipment, techniques, applications and people to define a social context (Kling and Scacchi, 1982). In addition, the web includes the commitment of additional resources such as training, skilled staff and support services, as well as the development of organisational arrangements, policies and incentives, to enable the management and use of IT (Kling and Scacchi, 1982).

In terms of knowledge, it has been argued that IT is not a neutral or object-like artefact, but embodies knowledge related to ideas about organisations and technical processes (Scarbrough, 1995). Since IT is designed, constructed and used by people, it is shaped by the interests, values and assumptions of a wide variety of organisational groups such as developers or users (Markus, 1983). Knowledge about IT is thus socially constructed, in the sense that different organisational groups have different underlying assumptions and expectations, which determine their understanding of the technology (Bijker et al., 1987). Weick (1990) conceptualises IT as "equivoque" meaning that they "admit of several possible or plausible interpretations and therefore can be esoteric, subject to misunderstanding, uncertain, complex and recondite" (p.2). This view of IT reflects a constructivist notion of technology that rejects the idea of an objective reality and emphasises the existence of constructions of reality instead (Bijker et al., 1987). Research based on the notion of social constructivism can adopt either a restrictive or thoroughgoing view of technology (McLoughlin, 1999). A restrictive view argues that once a technology is socially constructed, it has characteristics and capabilities, which can have effects such as causing organisational change (Zuboff, 1988). A thoroughgoing position, as advocated by Grint and Woolgar (1992), views the technical capabilities of machines and systems as never fixed, but essentially undetermined and constantly open to interpretive flexibility.

In addition, IT is neither fixed nor static, but provisional and dynamic (Weick, 1990). IT undergoes various transitions over time: from idea to development to use to modification. Even after IT appears to be fixed and complete, its stability is provisional, because new hardware and software is developed, existing features fail and are corrected, new standards are set, and users adapt IT for new and different uses (Orlikowski and Iacono, 2001). The provisional and dynamic notion has two implications for understanding IT. First, IT relates specifically to some time, place, discourse and community (Orlikowski and Iacono, 2000). As such, IT is bound up with the historical and cultural aspects of their ongoing development and use, which cannot be ignored or abstracted, as suggested by the received notion of IT (Orlikowski and Iacono, 2001). Second, IT is not a stable entity, but embedded in action and subject to change (Scarbrough, 1995).

Actor-network theory as one form of interpretive research grounded in notions of social constructivism (Latour, 1987; Callon et al., 1986) has received increased attention over the last years. Actor-network theory has been applied by various studies to understand the implementation of IT (Walsham and Sahay, 1999, Briers and Chua, 2001). Although the contribution of actor-network theory lies in the attempt to transcend the distinction between the social and the technical, at least two main kinds of criticism can be made (Grint and Woolgar, 1997). First, there are considerable difficulties in relating the theoretical idea to organisational practices, as it is not always clear where the boundaries of a network lie, nor which account of the network is to be taken as definitive. The analyst's story seems to depend on a description of the actual network, as if this was objectively available to observers of the scene. Second, actor-network theory tends to be weak in offering causal explanations of technological development. By treating both human and non-human entities equally and depicting them as being connected through a network, it is difficult to establish causal relationships.

This research adopts the notion of IT as being an equivoque (Weick, 1990) that is socially constructed, related to time and context, as well as provisional and dynamic. This view is supported by Orlikowski and Iacono (2001), who argue that in order to understand unprecedented IT such as B2B e-commerce, it is vital to conceptualise the emergence and evolution of IT as complex and changing technical and social processes. In terms of the position in the field of constructivist research, it takes a restrictive or "weak" constructivist view (McLoughlin, 1999), in that it assumes that through the process of social construction, organisational members assign stable characteristics and capabilities to technology. This view is consistent with the notion that, once constructed, knowledge takes on a static and objective-like quality for organisational members (Berger and Luckmann, 1967; Latour, 1987).

2.2.2 Positivist and Constructivist Notions of Knowledge

The term "knowledge" has been used freely so far in order to clarify the nature of this research. The term knowledge tends to be over-used, yet under-defined. The aim here cannot be to finally resolve the debates about knowledge, but to give an overview of current debates and define the position of this research to these issues. Based on a positivist philosophy, the majority of current organisational studies into knowledge implicitly take the ontological position that there is an apprehendable objective reality driven by immutable natural laws and mechanisms (Scarbrough et al., 1999; Tsoukas and Vladimirou, 2001). Knowledge itself is understood as a "justified true belief" (Nonaka, 1994), which can be uncovered through systematic analysis of sensory experience of a knowable external reality (Guba and Lincoln, 1994). It is considered to be universally true, if it can predict outcomes of activities in reality that can be replicated at all times and in all places.

This view leads to the traditional conceptions of knowledge as individual, disembodied and virtuous (Blackler, 1995). Building on the differentiation made by Polanyi (1967), one key

recurring concept in organisational studies of knowledge is the differentiation between tacit and explicit types of knowledge (Nonaka, 1994; Spender, 1996; Grover and Davenport, 2001). Whereas tacit knowledge defines knowledge that is beyond objective perception and dependent on sub- and pre-conscious modes of knowing, explicit knowledge refers to knowledge that can be abstracted from individuals and communicated to others (Nonaka, 1994). Knowledge is ultimately formed in the minds of individuals, who possess conceptual skills and cognitive abilities, such as the ability to develop complex rules and understand complex causations on an abstract level (Grover and Davenport, 2001). Such studies hold the view that since explicit knowledge can be detached from its context, it turns into a specific and self-contained entity that is objective and universal.

If knowledge can be divorced from its context and encoded in signs and symbols, then it should follow that it can be easily transmitted and stored electronically (Stein and Zwass, 1995; Davenport et al., 1998). According to the positivist view, knowledge represents a universally applicable and virtuous solution for solving problems and adding value to the organisation as key factors for economic performance and productivity (Drucker, 1993), as a scarce and valuable source of innovation and strategic advantage (Prahalad and Hamel, 1990), or as best practices that present apparently simple solutions to organisational problems in a variety of contexts (Grover and Davenport, 2001).

The received notion outlined above of knowledge as "truth" has been criticised widely for being simplistic (Blackler, 1995; Swan and Scarbrough, 2001; Tsoukas and Vladimirou, 2001). Informed by a constructivist philosophy, this critique suggests that knowledge is based on the ontological position that there are multiple realities as a result of intangible mental constructions of individuals, which are socially and experientially based (Guba and Lincoln, 1994; Schwandt, 1994). The form and content of the constructions of reality depend on individuals and groups sharing common constructions (Berger and Luckmann,

1967). Constructions about reality, and hence reality itself, are subject to continuous revision and change. From a constructivist perspective, truth loses its meaning as the ultimate representation of reality as it is provisional. Rather than evaluating knowledge about reality in terms of truth, it can be assessed as more or less informed or sophisticated. Knowledge about reality is literally created during the investigation process (Guba and Lincoln, 1994). It has been argued above that IT can be best understood as socially constructed. Hence, the socially constructed notion of knowledge embedded in IT appears to be the most suited for this research.

This view supports the notion of knowledge as social, specific to time and context, and processual. The assumption that individuals cognise and generate knowledge has been questioned on the grounds that the concept of the individual is not unproblematic. Far from being atomistic and isolated, the individual is part of wider social entities or collectives such as religions, professions or cultures shaping his or her rationality (Spender, 1996). Individual knowledge is the tip of the iceberg of preconscious collective knowledge, the vast bulk of which being embedded in social entities (Brown and Duguid, 1998). Blackler (1995) argues that knowledge does not appear as a separate category held by individuals, but permeates the social system. Knowledge is distributed not only in the organisational social systems, but in a broader industrial and societal context within which an organisation is embedded (Tsoukas, 1996). Knowledge is systemic in the sense that it is specific to the configuration of social systems. For this research, it means that knowledge is likely to be specific to an organisation and its industry.

As knowledge relates to a social system, it is specific to time and context (Lave, 1993). In terms of time, knowledge undergoes a constant construction and transformation through use and learning processes (Lave, 1993). Even if it were possible to extract abstract and encoded knowledge from a system, it would only be a valid representation of a particular status, like a snapshot, for a particular moment in time. In addition, the systemic nature of

knowledge provides a specific context in which it is situated (Lave, 1993). Context can be understood as a unique configuration and interrelation of a system spanning conventional organisational boundaries. In terms of codification of knowledge, the importance of context means that even if explicit knowledge existed, it would lose its intrinsic meaning, as it is related to a specific "unarticulated background" that resides in social practice (Tsoukas, 1996). Hence, tacit knowledge is the necessary component of all knowledge and therefore, explicit knowledge is always grounded on a tacit component (Polanyi, 1967). Since social practice includes a rich variety of experience and is unique to the individual or collectives, it cannot be fully captured by language or communicated easily electronically (Tsoukas, 1996). The notion of knowledge as being specific to time and context is reflected in the understanding of IT by this research as being provisional and dynamic. In the context of the integration of B2B e-commerce this implies that knowledge is constantly changing during the innovation process.

As outlined above, knowledge is accomplished through the dynamics of the systems and embedded in social practice. Hence, the unit of analysis for understanding knowledge is activity within the system (Blackler, 1995). Since knowledge permeates activity, it is pragmatic and purposeful, rather than neutral and benevolent (Tsoukas, 1996). This means that it is necessary to research knowledge in relation to purposeful activities. The purpose of activity in this research is the integration of B2B e-commerce. Yet past research on knowledge management has not usually done this, treating knowledge as something to be managed in and of itself.

2.2.3 Definition of B2B e-Commerce

B2B e-commerce has received increasing attention since the mid-1990s due to the diffusion of the Internet (Costello, 2000). Different terms have been used interchangeably to describe the consequences of the increased business use of the Internet, such as the IBM-inspired term e-business (Kalakota and Whinston, 1996), Internet commerce

(Lawrence et al., 1998), or digital economy (US Department of Commerce, 2000). For this research, the term B2B e-commerce is used and defined as "all activities between businesses, whether resulting in monetary transactions or not, that generate value both within a firm (internally) and with suppliers and distributors (externally), occurring over networks such as the Internet which use an open, non-proprietary standard" (OECD, 1999a, p.28,29). Similar to terms such as business process re-engineering (BPR) or supply chain management, the term B2B e-commerce refers to both a philosophy, e.g. change in business practice, and application, e.g. software tools (Markus, 2000).

B2B e-commerce has been heralded in popular management literature as supporting and improving business processes by conducting commercial transactions over the Internet (Kalakota and Robinson, 2001). The associated benefits of B2B e-commerce, such as the reduction of costs and the increase in productivity (OECD, 1999b), are "scientifically" explained by drawing on the transaction cost theory (Malone et al., 1987; Bakos, 1998). First, automated transactions enable a faster and more efficient transmission of information between linked firms, as compared to conventional means of communication such as fax or telephone. Second, electronic brokerage reduces a firm's search costs and therefore increases a firm's chances of finding the optimal source or outlet for a product or service it is trying to buy or sell. Third, electronic integration increases efficiency by coordinating business processes between firms. Between 70 and 85 per cent of total e-commerce value is estimated to be conducted between businesses, worth about US$1 trillion in 2003 worldwide (OECD, 1999b). Although estimates might vary, they indicate that B2B e-commerce is likely to be the most important form of e-commerce compared to other forms such as B2C e-commerce (Timmers, 1999). Still, Hempel and Kwong (2001) point out that the majority of literature bases the benefits of B2B e-commerce on the economics of transactions and largely ignores softer issues such as culture and trust in business relations.

On a more concrete level, B2B e-commerce can have a number of applications in organisations. In purchasing, B2B e-commerce applications such as e-fulfilment and e-procurement promise to lower procurement costs and to speed up the processing of purchase orders, by more efficient transmission of information (Basu and Kumar, 2002) and by effective procurement on electronic marketplaces (Scully and Woods, 1999; Kaplan and Sawhney, 2000). B2B e-commerce applications are also associated with more efficient logistics, as they enable better coordination between businesses through improved electronic communication (OECD, 1999b). A further application of B2B e-commerce is in the area of collaborative product design and development, where it is associated with speeding up the collaboration processes and hence reducing development time and shorten the time-to-market (US Department of Commerce, 2000). For sales and customer support, B2B e-commerce applications promise to cut out intermediaries by selling products and services directly to commercial customers, as well as to provide information such as product descriptions, technical support and order status inexpensively online (Timmers, 1999).

2.2.4 B2B e-Commerce as an IT-based Innovation to Research Knowledge

B2B e-commerce can be understood as an IT-based innovation, which appears to possess a number of innovation characteristics that make it particularly suitable for researching knowledge. Consistent with the view that knowledge is central, an innovation process can be defined as "the development and implementation of new ideas by people who over time engage in transactions with others in an institutional context" (Van de Ven, 1986, p.591). An innovation can be understood as IT-based if it involves a significant integration of IT applications (Scarbrough, 1998). Table 2.1 gives an overview and definition of the innovation characteristics of B2B e-commerce that bear particular relevance to knowledge. Their relation to knowledge is discussed in more detail in the remainder of this section. However, as academic research and the empirical evidence on B2B e-commerce is

speculative and mostly anecdotal (Straub et al., 2002), the innovation characteristics outlined in this section are indicative.

	Innovation characteristics of B2B e-commerce
Complex	Innovation that challenges conventional ideas about the way business is conducted (Kalakota and Whinston, 1996; Timmers, 1999)
Configurational	Innovation that needs to be blended with existing social and technical systems (Sambamurthy and Zmud, 2000)
Pervasive	Innovation that involves and affects various organisational functions and hierarchy (Chatterjee et al., 2002; Willcocks and Sauer, 2000)
Transformational	Innovation that requires significant organisational change (Keen and McDonald, 2000; Kalakota and Robinson, 2001)

Table 2.1: Anticipated Innovation Characteristics of B2B e-Commerce

B2B e-commerce is frequently characterised as a genuinely complex concept that challenges conventional ideas about the way business is conducted (Kalakota and Whinston, 1996; Timmers, 1999). Complexity has been referred to as the extent to which an innovation is perceived as relatively difficult to understand and use (Zaltman et al., 1973; Rogers, 1995). Due to the ongoing advances in web-based technology, new applications such as B2B marketplaces are continuously developed (Scully and Woods, 1999). Organisations need to analyse the opportunities and challenges new technology offers and apply them to the specific context of the organisation (Turban et al., 2000). However, it is likely that organisational groups may have different views on the impact of the new technology and how the organisation should respond to it (May, 2000), as knowledge is distributed across occupational groups. Thus, B2B e-commerce can be understood as an equivoque that admits of several possible or plausible interpretations and can therefore be subject to high levels of misunderstanding and uncertainty (Weick, 1990). B2B e-commerce offers the opportunity to investigate how organisations or organisational groups make sense of new technology and construct knowledge during IT-based innovations.

It has frequently been argued that one of the main characteristics of B2B e-commerce is the alignment between technology and business processes, so that technology is fully integrated into the way an organisation conducts business (Sambamurthy and Zmud, 2000). Thus, B2B e-commerce can be understood as a configurational technology, e.g. a technology comprising varying software and hardware blended with organisational practice, in order to meet the particular needs of the adopting organisation (Clark and Staunton, 1989; Fleck, 1994). In terms of technology, although there are standard software solutions for B2B e-commerce applications, they need to be integrated with existing legacy systems, which tend to have grown organically over the past and were tailored to the specific needs and situation of each company (Sauer, 2000). Equally, established organisational processes have to change in order to achieve the alignment between technology and business processes required for achieving the anticipated benefits (More and Ruddle, 2000). B2B e-commerce offers the opportunity to investigate how organisations integrate new knowledge to change technology and business processes during IT-based innovations.

B2B e-commerce has been characterised as a pervasive innovation, as it affects various organisational functions (Chatterjee et al., 2002). This attribute corresponds to a high degree of scope (Zaltman et al., 1973), which refers to the proportion of organisational members that are expected to be affected and to change their behaviours. Major organisational benefits are thought to derive from a seamless integration of technology and business processes across functional boundaries (Willcocks and Sauer, 2000). Hence, the importance of involving different functions such as IS, marketing, purchasing and finance in cross-functional teams has been emphasised (Turban et al., 2000). It has been suggested that cross-functional teams can serve as a knowledge pool of different kinds of skills and expertise, as well as an integrating force to bridge different bodies of knowledge (Turban et al., 2000; May, 2000). However, the problem with cross-functional teams is that each participating group is likely to have a particular view of B2B e-commerce which could

make the work in the team, such as identifying objectives and finding consensus, difficult (May, 2000). B2B e-commerce offers the opportunity to investigate how different organisational groups seek to share knowledge during IT-based innovations.

A further characteristic of B2B e-commerce is the strong association with organisational transformation, in order to gain major benefits (Keen and McDonald, 2000; Kalakota and Robinson, 2001). Thus, B2B e-commerce is expected to be a radical innovation that produces fundamental changes in the activities of an organisation and represents clear departures from existing practices (Damanpour, 1991). As the other innovation characteristics indicate, organisational transformation is likely to occur in different organisational functions simultaneously and affect both technology and business processes. It has been emphasised that skills for managing organisational change are needed during the integration of B2B e-commerce (May, 2000). However, the experience from the integration of electronic data interchange (EDI), which shares similar innovation characteristics with B2B e-commerce, into the technical and organisational system, has shown that such transformation is marked by significant difficulties due to resistance within and outside the organisation (Swatman and Swatman, 1992). B2B e-commerce offers the opportunity to investigate how knowledge changes during IT-based innovations.

2.3 Understanding Knowledge in IT-based Innovations

In the previous section, the notion of IT and knowledge as adopted by this research has been discussed and the case has been made as to why B2B e-commerce is an opportunity to research knowledge. The aim of this section is to outline the existing research linking knowledge with IT-based innovations and develop an analytical framework for this research. This is done, first, by discussing current studies that offer analytical frameworks for understanding knowledge in IT-based innovations. Due to their limitations, additional research is introduced that depicts knowledge in organisations as a set of different

knowledge processes. Finally, a framework is developed that focus on knowledge processes in IT-based innovations.

2.3.1 Existing Conceptual Research into Knowledge and IT-based Innovations

Recent studies have placed knowledge centre stage in the analysis of IT-based innovation diffusion (e.g. Hislop et al., 1997; Newell et al., 2000) and implementation (e.g. Scarbrough, 1995; Huang et al., 2001). The studies have in common that they take a process-oriented perspective on IT-based innovations. Process research examines the development of the innovation over time with the unit of analysis being the innovation process itself (Lucas et al., 1990). Whereas earlier process research conceptualised IT-based innovation as a series of separate stages that unfold in a linear fashion over time (e.g. Zaltman et al., 1973; Cooper and Zmud, 1990), process research focusing on the role of knowledge acknowledges the iterative and overlapping nature of IT-based innovations (Clark, 1987; Fleck 1994). Attention is given to the personal, organisational, technological and environmental context within which IT-based innovation takes place (Wolfe, 1994).

IT-based innovations are conceptualised as a complex design and decision process by which external ideas and knowledge about complex IT are appropriated alongside localised, context-specific organisational knowledge, in order to develop firm-specific solutions (Clark and Staunton, 1989). Appropriation refers to the unpacking of supplied innovations and their reconfiguration to match the specific requirements and context of the adopting organisation (Clark, 1987). IT-based innovations are not perceived as the implementation of technological artefacts such as hardware or software, but as the integration of ideas and knowledge underpinning such technology (Newell et al., 2000). Knowledge in the context of IT-based innovations is assumed to be socially constructed, in the sense that interpretations and meaning around complex IT arise and affect the development and interaction with it (Weick, 1990; Coombs et al., 1992).

One theoretical framework for the analysis of the IT-based innovation process was based on Rogers (1995), developed by Clark et al. (1992) and further refined by Robertson et al. (1996) and Newell et al. (2000). The framework depicts the innovation as a set of four iterative, recursive and overlapping decision episodes, each representing an organisational process of problem-solving and decision-making (Clark et al., 1992). The episode of agenda formation relates to the acquisition and initial sharing of new ideas by organisational members, in order to match the fuzzy image of technology with the unique requirements of the organisation, and formulate solutions on a general level. The selection episode relates to the further processing and refinement of ideas within the organisation, so that those ideas are chosen to go forward for further development that are seen as a solution to organisational problems or issues. The implementation episode describes the actual introduction of the selected solution into the organisation and its application to the local context in the form of new technologies and business processes. The usage episode refers to the process by which an implemented solution becomes embedded within organisational practices and routines, so that it is an accepted part of the organisational culture. At this point, new ideas become used routinely in the organisation and would no longer be referred to as innovation (Clark and Staunton, 1989).

However, such existing research falls short of providing a coherent and analytical concept to depict the role of knowledge in IT-based innovations. First, current research has failed to provide greater detail on this innovation process itself. Terms such as knowledge integration or appropriation tend to be used (e.g. Clark et al., 1992; Hislop et al., 1997; Galliers and Swan, 1999) without giving any insights as to how organisations undertake this task. Second, theoretical frameworks such as the one by Clark et al. (1992) present IT-based innovation as organisational activities in terms of problem-solving and decision-making. Yet, it does not place knowledge centre stage in the theoretical conceptualisation, which would be the basis for gaining a better understanding of knowledge related issues in IT-based innovations. Third, research on knowledge in IT-based innovation is highly

fragmented and focused on particular issues in relation to the innovation process. Such issues include, for example, the politics of decision-making and change (Knights and Murray, 1992), social construction of new meaning and understanding (Orlikowski and Gash, 1994), development of social cultures and communities of practice (Brown and Duguid, 1998), and social networking for knowledge acquisition and distribution (Hakansson and Snehota, 1995). Although the focus on these issues is a valuable contribution, it does not add to our conceptual understanding of the role of knowledge in IT-based innovation in a focused way.

This evaluation of the current literature has shown that there is a need to develop an analytical framework that explicitly focuses on the role of knowledge in IT-based innovations. The aim of this research is to pull together fragmented literature in order to look at the IT-based innovation as a whole. Innovation episodes such as agenda formation, selection, implementation and usage provide an anchor point for the analysis of knowledge in IT-based innovations as they provide the purpose of organisational activities related to knowledge. The process perspective of IT-based innovation is well suited for two reasons. First, it reflects the socially embedded and dynamic nature of knowledge as adopted by this research above. Second, process perspectives also acknowledge, to varying degrees, the socially constructed and contextual nature of IT.

2.3.2 Knowledge Processes

The previous discussion has shown the relevance of a process perspective on knowledge and IT-based innovations. In this section, research is discussed that suggests systematic frameworks to analyse knowledge processes in organisations. The concept of knowledge processes reflects the idea that knowledge is the product of an ongoing set of organisational activities embedded in the social and physical structures of the organisation (Pentland, 1995). The aim of this section is to develop a framework of knowledge processes to analyse knowledge in IT-based innovations.

Huber (1991) identified four processes related to knowledge in organisations: "knowledge acquisition", "information distribution", "information interpretation" and "organisational memory". Huber (1991) uses the terms "information" and "knowledge" interchangeably. "Knowledge acquisition" refers to the processes through which organisations obtain knowledge externally and create knowledge internally. "Information distribution" is the process by which knowledge is disseminated across an organisation to facilitate organisational learning. "Information interpretation" is the process by which organisational units develop a common interpretation and shared understanding. Finally, "organisational memory" refers to storage of knowledge in the form of organisational routines and computer-based memory systems. Huber's (1991) aim was to categorise published work in the field of organisational learning. However, the framework has been criticised for embodying a positivist epistemology that treats knowledge as an objective entity (Pentland, 1995). As a result, the framework fails to address the embedded and constructivist nature of knowledge.

In response to Huber (1991), Pentland (1995) introduced a set of five knowledge processes: "construction", "organisation", "distribution", "storage" and "application". "Construction" is the process of adding or replacing new material within the collective stock of knowledge. "Organisation" refers to the process by which bodies of knowledge are related to each other, classified, or integrated. "Storage" is the process of the retention of socially ratified knowledge. "Distribution" refers to the process of communicating knowledge to places where it is needed and it can be applied. "Application" is the process of applying knowledge to achieve performance improvements. Pentland (1995) argues that this framework is particularly appropriate to the analysis of knowledge as it emphasises the socially constructed, distributed and embedded nature of knowledge in organisations. Although the notion of knowledge suggested by Pentland (1995) reflects the position of this research, the differentiation between the knowledge processes proposed is not entirely

clear. For example, it can be argued that the organisation of knowledge is inseparable from the construction of knowledge, as adding and replacing new material within the collective stock of knowledge is equal to the classification and integration of knowledge.

Grover and Davenport (2001) suggest a set of four knowledge processes: "generation", "codification", "transfer" and "realisation". They propose that these knowledge processes are linearly linked and form a knowledge cycle. Generated knowledge is codified, then transferred and finally applied in a different context. This cycle bears resemblance to Nonaka's (1994) description of knowledge creation where tacit knowledge is made explicit (codified), transferred and used elsewhere. "Knowledge generation" includes all processes involved in the acquisition and development of knowledge. "Knowledge codification" involves the conversion of knowledge into accessible and applicable formats. "Knowledge transfer" includes the movement of knowledge from its point of generation or codified form to the point of use. "Knowledge realisation" refers to the process of creating value for the recipient of knowledge and ultimately for the firm. Grover and Davenport (2001) clearly adopt a positivist notion of knowledge that defines knowledge as an objective resource that can be controlled and manipulated by management. This notion of knowledge stands in stark contrast to the way knowledge is defined by this research in section 2.2.2.

According to Alavi and Leidner (2001), there are four socially enacted knowledge processes: "creation", "storage/retrieval", "transfer" and "application". "Creation" involves developing new content or replacing existing content within the organisation's knowledge. "Storage/retrieval" refers to knowledge being stored in the organisational memory and retrieved to influence present organisational activities. "Transfer" refers to the process, by which knowledge is disseminated among individuals and groups. "Application" refers to knowledge being applied to create organisational capabilities such as organisational routines. Alavi and Leidner (2001) base their knowledge process

framework on the sociology of knowledge (Berger and Luckmann, 1967) and the view of organisations as social collectives and knowledge systems (Holzner and Marx, 1979). The framework acknowledges the socially constructed nature of knowledge which is seen to be embodied in individuals' cognition and practices as well as the collective practices and culture (Alavi and Leidner, 2001). Alavi and Leidner (2001) point out that the knowledge processes do not present a monolithic set of activities, but an interconnected and intertwined set of activities. The framework suggested by Alavi and Leidner is consistent with the notion of knowledge adopted by this research.

The four frameworks reflect the evolutionary development of the way knowledge processes are commonly defined. Whereas Huber (1991) and Pentland (1995) aim at explaining organisational learning, Alavi and Leidner (2001) and Grover and Davenport (2001) intend to depict processes for knowledge management. Still, all four knowledge frameworks depict knowledge processes independently of the purpose for which it facilitates organisational learning or enables knowledge management. Knowledge processes tend to be abstracted from activity or purpose, which contradicts the notion of knowledge adopted in this research.

A comparison of the different knowledge process frameworks is depicted in Table 2.2. Despite being based on different notions of knowledge, there are similar knowledge processes across frameworks. This suggests that these knowledge processes play an important role in analysing knowledge. Of particular interest are the frameworks suggested by Pentland (1995) and Alavi and Leidner (2001), as they are based on the same notion of knowledge adopted in this research. The frameworks differ, in that Alavi and Leidner (2001) define the knowledge process of creation, which Pentland (1995) separates into knowledge construction and organisation. It has been argued earlier that knowledge construction and organisation are inseparable rather than being two distinguishable knowledge processes. Based on the frameworks, four knowledge processes of creation,

transfer, storage and applications are frequently identified. Table 2.2 also shows that three processes of creation, sharing and retention are most relevant for this research, as argued below.

Huber (1991)	Pentland (1995)	Grover and Davenport (2001)	Alavi and Leidner (2001)	Knowledge processes adopted by this research
Acquisition Interpretation	Construction Organisation	Generation	Creation	Creation
Distribution	Distribution	Transfer	Transfer	Sharing
Organisational Memory	Storage	Codification	Storage/Retrieval	Retention
	Application	Realisation	Application	

Table 2.2: Knowledge Process Frameworks

Knowledge creation refers to the process through which knowledge is added or replaced within the collective stock of knowledge (Alavi and Leidner, 2001). Findings indicate that organisations create knowledge in IT-based innovation through different strategies such as in-house development, purchase of standard products, and consultant/supplier-assisted development (Scarbrough, 1995). Pentland (1995) points out that knowledge creation is a process of giving activities meaning and developing shared understanding, which involves relating, classifying and organising different bodies of knowledge. In section 2.5, research dealing with knowledge creation in IT-based innovations is discussed in greater detail.

Knowledge distribution refers to the transfer of knowledge among a social community (Pentland, 1995). Particularly recently, it has been argued that ICT such as intranets play an important role in knowledge distribution (Grover and Davenport, 2001). However, research indicates that the exchange of knowledge is fundamentally a social process heavily influenced by personal contacts, friendships and commitment to the organisation (Constant et al., 1994; Brown and Duguid, 1998). For that reason, this research will use the term "knowledge sharing" to reflect the importance of social interaction for the exchange of knowledge. Knowledge sharing is further detailed in section 2.6.

Knowledge storage within the organisation refers to the capability to retain and transmit knowledge from the past to future members of the social system (Pentland, 1995). This research will use the term "knowledge retention" to indicate the socially embedded nature of knowledge that cannot be mechanically stored in electronic databases as recent research suggests (Stein and Zwass, 1995; Grover and Davenport, 2001). Relevant research concerning knowledge retention is discussed in section 2.7.

Pentland (1995) and Alavi and Leidner (2001) argue that application is a distinct knowledge process since knowledge needs to be applied in order to generate organisational benefits. Yet the process of knowledge application must be critically evaluated for two reasons. First, the authors fail to outline what is actually meant by knowledge application. For example, Alavi and Leidner (2001) use the terms knowledge application and knowledge integration interchangeably. Based on the classification of Demsetz (1991), they suggest that knowledge is applied in directives, organisational routines and self-contained task teams which were earlier identified as mechanisms for storing knowledge. Hence, the difference between knowledge application and retention remains unclear. Second, the notion of knowledge application implicitly reflects the received notion of knowledge, which identifies knowledge as a separate and self-consisting entity that can be applied to achieve a given aim. However, it has been argued above that knowledge is embedded in action and does not appear as a separate category in organisations (Blackler, 1995). Hence, the unit of analysis for understanding knowledge is purposeful activity (Blackler, 1995). In this research, the purposeful activity is the implementation of B2B e-commerce. For these reasons knowledge application is not included in the analytical framework as a separate knowledge process.

This section identified three major knowledge processes of creation, sharing and retention that have been used to analyse the role of knowledge in organisations. These three

knowledge processes provide a basic framework for the analysis of knowledge in IT-based innovations.

2.3.3 Knowledge Processes in IT-based Innovations

The initial aim in this section was to identify analytical frameworks that would help in analysing knowledge in IT-based innovations. Rather than finding one coherent framework, the literature review revealed two frameworks that focus on different aspects. On one hand, innovation episodes (Clark et al., 1992) provide a framework to understand IT-based innovations as a purposeful activity in terms of problem-solving and decision-making. Yet, it does not explicitly focus on knowledge aspects in IT-based innovations. On the other hand, knowledge processes (Pentland, 1995; Alavi and Leidner, 2001) offer a framework for analysing knowledge in organisations. Still, it does not address issues regarding IT-based innovations. However, drawing on both frameworks simultaneously, as depicted in Figure 2.2, would provide an analytical framework for the analysis of knowledge in IT-based innovations. The two frameworks can be linked because they make similar assumptions. First, they are based on the notion of knowledge as being socially constructed and an integral part of the organisational system. Second, they take a processual approach to understanding the organisational activities. The benefits of linking the frameworks are detailed in the remainder of this section.

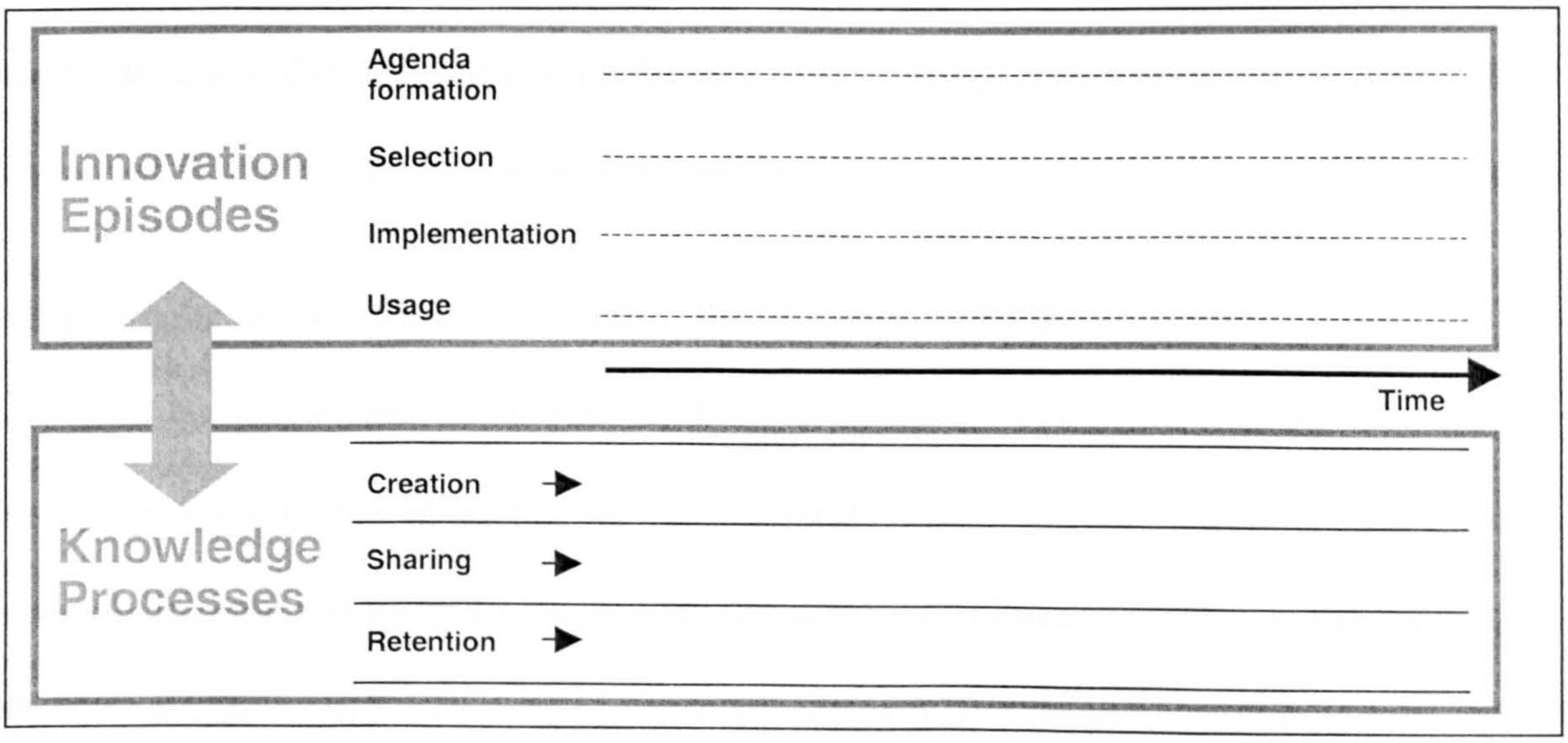


Figure 2.2: Linking Innovation Episodes and Knowledge Processes

The innovation episode framework suggests that there are four main activities during IT-based innovations: agenda formation, selection, implementation and usage. Innovation episodes help to understand organisational activities related to problem-solving and decision-making in the context of IT-based innovations. For analysing the role of knowledge in IT-based innovations, the innovation episode framework can serve as what Walsham (1995) describes as a "scaffolding" that helps in developing other frameworks and is removed once it has served its purpose. The benefit of drawing on the innovation episode framework is that the episodes focus on purposeful activities e.g. the integration of new IT. It has been argued earlier that the unit of analysis for understanding knowledge is purposeful activities (Blackler, 1995). Thus, the innovation episode framework guides the analysis of knowledge in that it highlights the purposeful activities in IT-based innovation.

The knowledge process framework suggests that there are three main knowledge processes in organisations: knowledge creation, sharing and retention. The three knowledge processes occur continuously and simultaneously (Alavi and Leidner, 2001). Alavi and Leidner (2001) argue that knowledge processes do not represent a monolithic set of activities but an interconnected and intertwined set of activities. This suggests that knowledge processes might be connected in some way which needs to be considered in the analysis of knowledge processes. The benefit of drawing on this framework is that it explicitly and coherently focuses on the role of knowledge across organisational activities, including those relating to innovation episodes.

Of particular interest for this research is the literature on B2B e-commerce that covers issues of knowledge and integration of B2B e-commerce. Yet a review of the relevant literature found that most publications deal with B2B e-commerce on a conceptual level, making assumptions about its innovation characteristics (Timmers, 1999; Kalakota and Robinson, 2001). In contrast, empirical evidence of B2B e-commerce is limited, speculative and disproportionately focused on the United States (US). The same few US

companies tend to be mentioned repeatedly in connection with specific benefits of B2B e-commerce. These companies include General Electric for lower procurement costs (US Department of Commerce, 2000; OECD, 1999a, Kalakota and Robinson, 2001) and Boeing for online sales of spare parts (Kalakota and Robinson, 2001; Costello, 2000). However, such examples lack a detailed description or analysis of how new technology was integrated in the organisation. The overall absence of empirical studies of the integration of B2B e-commerce could be explained by its relative newness. As with other IT-based innovations such as BPR, empirical research lags behind practical application in organisations. This research needs to draw on a wider body of empirical studies that can be linked to knowledge processes in IT-based innovations.

It has been argued that by drawing on the concept of innovation episodes and knowledge processes, a framework can be developed that helps analysing knowledge in IT-based innovations. As the empirical evidence of B2B e-commerce is limited, this research needs to draw on a wider body of literature dealing with knowledge in IT-based innovation.

2.4 Managing Knowledge in IT-based Innovations

The aim of this section is to discuss how knowledge in IT-based innovation can be managed. The question of the manageability of knowledge in IT-based innovation is of particular relevance as it would provide practitioners especially with guidance on facilitating knowledge processes. To start with, this section first defines knowledge management and outlines the research streams within this field. Then, with reference to the analytical framework adopted by this research, the manageability of knowledge processes as well as IT-based innovations is discussed in greater detail. The section concludes by outlining the role of power in relation to the manageability of knowledge in IT-based innovations.

2.4.1 Knowledge Management

Interest from practitioners and academics in knowledge management has seen an exponential growth over recent years (Scarbrough et al., 1999). This has been reflected by the coverage in popular business literature (e.g. Davenport and Prusak, 1998), research conferences such as *Knowledge Management: Concepts and Controversies*, at Warwick University (2000), and research agendas of public policing makers (e.g. ESRC's Evolution of Business Knowledge Programme). There have also been special issues about knowledge management in academic journals such as the *California Management Review* for 1998, 40(3), the *Journal for Management Studies* for 2000, 37(6), the *Journal of Information Technology* for 2001, 16(2), and the *Journal of Management Information Systems* for 2001, 18(1). It has frequently been argued that our society is in a transition from an industrial economy that emphasised traditional resources such as land, labour and financial capital to a knowledge economy based on advanced IT and knowledge workers (Drucker, 1969; Earl, 1999). The fundamental assumption underpinning the interest in knowledge management is that knowledge can be managed and that organisational benefits derive from managing knowledge (Stewart et al., 2000). For example, knowledge is seen to be the key to a firm's capacity to innovate and hence the primary source of competitive advantage (Grant, 1996b). Although advocates of knowledge management are well aware of its faddish characteristics, it is argued that knowledge management will establish itself as a new and enduring aspect of management and organisation (Earl, 2001).

Knowledge management is used broadly to refer to "the capacity (or process) within an organisation to maintain or improve organisational performance based on experience and knowledge" (Pan and Scarbrough, 1999, p.360). More narrowly, knowledge management "encompasses any processes and practices concerned with the creation, acquisition, capture, sharing and use of knowledge, skills, and expertise (Quintas et al., 1996) whether these are explicitly labelled as 'knowledge management' or not" (Swan et al., 1999, p.264).

Storey and Quintas (2001) refer to knowledge management as, apart from the creation and sharing, also to the sourcing, mapping and measuring of knowledge. As the array indicates, one major criticism of much of the literature on knowledge management is the ambiguous and all-embracing use of the term knowledge or as Alvesson and Kärreman (2001) put it "knowledge is everything, everything is knowledge" (p.998). The fundamental problem of this is that if knowledge is used as an all-encompassing label for a rich diversity of phenomena, it becomes a rather unrevealing analytical concept (Tsoukas and Vladimirou, 2001).

Within the field of knowledge management, two research streams are frequently been identified (Ruggles, 1998; Alvesson and Kärreman, 2001). One research stream can be traced back to the emergence of new ICT such as network computing, search engines and databases. Its focus is on the use of such ICT to store, search for and transfer knowledge within and across organisations (Grover and Davenport, 2001). Such research is largely based on the positivist notion of knowledge viewing it as a virtuous and self-contained entity that is subject to management intervention. The other research stream originates from the field of organisational learning (Scarbrough et al., 1999) and focuses on the social aspects of knowledge. Knowledge management is not seen as matter of ICT but a social process e.g. connecting people and building communities (Brown and Duguid, 1998). This stream of research tends to adopt a constructivist notion of knowledge placing emphasis on the socially constructed and embedded nature of knowledge, as does by this research.

This research can be associated with the view of knowledge management focusing on social processes. This view is coherent with the notion of knowledge adopted by this research. Knowledge cannot be controlled or coordinated in the classical sense of management, but is a more dispersed and organic phenomenon. Knowledge can be managed in the sense that management can create an environment that encourages and

values knowledge creation and sharing (McDermott, 1999), but not managed as an objective entity in and of itself.

2.4.2 Manageability of Knowledge Processes

Addressing the question of the manageability of knowledge processes, a number of authors have argued that knowledge processes can be both planned and emergent (Nidumolu et al., 2001; Grover and Davenport, 2001; Alvesson and Kärreman, 2001). Knowledge processes can be referred to as planned if they are the result of managerial interventions (Grover and Davenport, 2001). While Grover and Davenport (2001) argue that planned knowledge processes are the result of conscious knowledge management initiatives, the discussion above has shown that the management of knowledge is not about direct control but creating opportunities for knowledge processes to occur. Thus, planned knowledge processes can be understood as managerial interventions that indirectly affect knowledge creation, sharing and retention by generating a particular context. For example, the managerial selection of project team members has an influence on the way knowledge is shared within the project team and with other organisational members (Cohen, 1998). In the context of IT-based innovations where the focus of managerial activities is on the integration of new IT rather than on the knowledge management initiatives, planned knowledge processes are likely to be an integral part of the management to implement new technology.

However, research has shown that knowledge processes also occur in a more emergent form through an ongoing activity enacted by organisational members trying to make sense of and act coherently in the world (Orlikowski, 1996). Nidumolu et al. (2001) found that knowledge processes emerge as part of the ongoing social interactions that organisational members undertake in order to perform their jobs. Such emergent knowledge processes might be triggered, but not influenced, by managerial inventions. This notion is supported by the situated learning literature that proposes a greater sensitivity to emergent, unplanned

organisational learning and knowledge processes caused by the everyday actions of organisational members (Lave and Wenger, 1991). Emergent knowledge processes are likely to occur in the context of IT-based innovations as the integration of new IT causes a range of informal activities (Orlikowski, 1996) that might have an influence on how knowledge is created, shared and retained.

It has been found that although planned and emergent knowledge processes occur simultaneously (Alvesson and Kärreman, 2001), there can be tension between them when managerial activities are insensitive to the emergent nature of ongoing knowledge processes in the organisation (Nidumolu et al., 2001). Nidumolu et al. (2001) found that planned top-down knowledge management initiatives failed because they contradicted the emergent organisational activities to create and share knowledge needed to perform day-to-day tasks. Overall, management had limited control over knowledge processes as organisational members largely relied primarily on informal processes such as talking to experts and learning by doing.

The implication for this research is that in order to analyse the management of knowledge in IT-based innovation, the framework introduced above needs to consider both planned and emergent activities. Regarding the notion of management, it becomes apparent that knowledge is "managed" implicitly as an integral part of organisational activities such as the creation of a project structure to implement new technology (Blackler, 1995), rather than explicitly through knowledge management initiatives. The notion of management is explored in more detail in the following section.

2.4.3 Manageability of IT-based Innovations

Paralleling the idea of planned and emergent knowledge processes, there are two competing perspectives on the manageability of IT-based innovations, either seeing the trajectory of the innovation process controlled by management, or emphasising the element

of improvisation and drift (Avison and Fitzgerald, 1999; Ciborra et al., 2000). The concept of control and drift in IT-based innovation has parallels with the concept of planned and emergent knowledge processes that it presents a dichotomy in terms of depicting activity as a result either of controlled or of unintended behaviour. However, whereas the concepts of planned and emergent refer specifically to knowledge processes, the concepts of control and drift refer more generally to the manageability of IT-based innovations.

The most dominant perspective is "management as control" typical of the mainstream literature in IS research (Ciborra et al., 2000). The IS management literature privileges the ideal image of organisations as pyramids which includes the notion of an orderly, top-down process of strategic planning as well as the prescription of how to measure and control resources (Weill and Broadbent, 1998). Ciborra et al. (2000) argue that managerial prescriptions coming from consulting and objective theoretical models assume an illusory level of control of IT-based innovations. Paralleling this notion, most literature on knowledge management treats management as either being unproblematic (e.g. Hansen et al., 1999) or, more commonly, as given and self-evident (e.g. Lam, 2000). This idea of management reflects the classic formulation of management as planning, organising, coordinating and controlling work (Alevsson and Kärreman, 2001). In the context of this research, the management as control perspective would suggest that the trajectory of IT-based innovation is fully controlled and directed by conscious management activities.

The management is control perspective is increasingly being criticised for not taking account of an organisational reality that tends to be "messy" and full of surprises and unexpected outcomes (Ciborra et al., 2000). This perspective offers a stark contrast to the ideal world of "how things should be" suggested by the management as control perspective. Ciborra et al. (2000) use the metaphor of "drift" to describe the phenomenon that the development of new IT tends to deviate from its planned purpose for a variety of reasons often outside anyone's influence. Studies introduce a new vocabulary to describe

"management as drift". In the context of strategic applications of IT, Ciborra (1994) use the terms "muddling through" and "tinkering" to describe how managers react to turbulent and unpredictable circumstances in systems development and use. Orlikowski (1996) and Ciborra (1999) refer to the term "improvisation" to highlight how managers react knowledgeably to solve sudden problems far removed from the classical sense of decision-making. The notion of drift would suggest that IT-based innovation is marked by unexpected outcomes and deviations that require frequent adaptations, if not re-inventions, of the initial solution (Bikson, 1996).

The literature on B2B e-commerce appears to be dominated by the management as control perspective (e.g. Costello, 2000, Kalakota and Robinson, 2001). B2B e-commerce is viewed as a deterministic force that inevitably redefines the nature of customer relationships, products and services, business partnerships, and economic markets within and outside the organisation (Sambamurthy and Zmud, 2000) as well as disrupting established recipes of competition and business conduct (Venkatraman and Henderson, 1998). There is a plethora of prescriptive management literature offering an abundance of strategic recipes to take advantage of business opportunities enabled by new IT (e.g. Timmers, 1999; Scully and Woods, 1999). The rhetoric adopted by this management literature promotes the benefits and advantages of B2B e-commerce and, at the same time, ignores or downplays difficulties and problems related to its implementation. Although previous experience of technological change strongly suggests that implementing new technologies is a profoundly complex and uncertain endeavour (Markus and Robey, 1988; Orlikowski, 1996; Kling and Lamb, 2000), the discussion about e-commerce in general reflects a notion of technological determinism and functionalism (Orlikowski and Iacono, 2000).

The literature on the manageability of IT-based innovation indicates that the role of "management as control" is limited in determining the trajectory of IT-based innovation.

Instead, the trajectory is influenced by unexpected and unintended organisational activities, a phenomenon, described as technology drift (Ciborra et al., 2000). The notion of drift reflects the idea of IT-based innovations as unpredictable and emergent, as outlined above (Clark, 1987; Newell et al., 2000). Regarding the role of knowledge in IT-based innovations, this research needs to investigate in which ways the trajectory of the IT-based innovation was directly controlled through management intervention or drifted as part of organisational members' daily activities.

2.4.4 Role of Power in the Manageability of Knowledge in IT-based Innovations

A fundamental assumption in the literature dealing with knowledge is that knowledge is a useful and virtuous entity that enables or facilitates innovation. So far, the discussion about knowledge in IT-based innovation has shown that knowledge is not only a complex concept but also difficult to manage as the existence of emergent knowledge processes and the notion of drift in IT-based innovation indicated. In addition, it has been argued that the common perception of knowledge as being useful and virtuous entity needs to be questioned (Alvesson and Kärreman, 2001). Since there are difficulties defining the concept of knowledge, it is not self-evident that it is central to the organisation's capacity to innovate, as frequently claimed (Drucker, 1993, Grover and Davenport, 2001).

According to Foucault (1980) knowledge is not a neutral and functional tool for accomplishing something socially valuable, such as the implementation of new technology, but is closely related to power. Foucault (1980) views power not as a commodity that is held or possessed by individuals or institutions but as relational, which is associated with practices, techniques and procedures. Applied to an organisational context, Walsham (1993) argues that power and its use in political activity pervade all action and discourse in organisations. The exercise of power is a continuous process that has subtle local properties and local actions are linked in a complex way to more general networks and institutional frameworks. Foucault (1980) argues that power and knowledge are

intrinsically related: "The exercise of power perpetually creates knowledge and, conversely, knowledge constantly induces effects of power. It is not possible for power to be exercised without knowledge, it is impossible for knowledge not to engender power" (p.52). Consequently, knowledge is not necessarily virtuous but has a potentially negative side to it. In the context of IT-based innovations, an intervention of a supposedly knowledgeable actor may work for other reasons than facilitating the innovation process. The intervention may be in effect a mechanism of disciplinary power to determine the formation and accumulation of knowledge that reinforces a wider conceptual system in operation, such as truth and reality (Townley, 1993).

Existing power-knowledge relations are disturbed by the introduction of new technology and, as a consequence, IT-based innovations reproduce or amplify existing strains and conflicts, as well as challenging existing knowledge within the organisation (Scarbrough and Corbett, 1992). Research has found that organisational groups shape the framework within which the scope of organisational change was discussed to preserve and enhance their perceived interests and power status (Knights and Murray, 1992; Brown, 1998; McLoughlin et al., 2000). Power and politics also played a major role in determining the type of people involved or excluded from decision-making, thereby attaching value to particular bodies of knowledge (Hislop et al., 2000). Another common finding is that due to political conflict, organisational groups stop sharing knowledge relevant to the successful integration of IT-based innovations (Coombs et al., 1992; Levine and Rossmoore, 1994). Brown (1995) found that an implementation team sought to manipulate interpretations by stakeholders, in order to gain wider acceptance of the new technology. Each interpretation was designed to legitimate the new technology with respect to particular stakeholder groups by appealing to either actual or espoused interests, as perceived by the implementation team.

It has been suggested that the location of management within the organisational division of labour imbues them with a level of formal, hierarchical authority and gives them an element of control over others (Alvesson and Willmott, 1996). It has been found that the way formal authority is translated into actual power to influence the process of change, was shaped significantly by the organisational context (Hales, 1993). In the context of IT-based innovations, Hislop et al. (2000) found the perceived legitimacy of management's authority to be an important contextual issue. Where formal hierarchical responsibilities were respected, and decision-making processes tended to be formal, formal authority was regarded as legitimate. Yet formal authority was strongly challenged where management was perceived to lack relevant business knowledge and there was a history of independent decision-making. As a result, while formal authority is important, it does not automatically imbue management with the power to implement their vision of new IT unmodified. IT-based innovations can be mediated through politics, making the outcome of the integration process uncertain (McCabe, 1996).

Judging from the innovation characteristics of B2B e-commerce, issues of power and politics are likely to be critical. Therefore, this empirical investigation needs to pay attention to two areas. First, analysis is needed of how power and politics influenced processes of knowledge creation, sharing and retention. This might be reflected in the way the organisational agenda is set, or in the composition and activities of the project team. Second, it needs to investigate whether and how formal authority was challenged and the trajectory of the integration of B2B e-commerce thereby changed. Such changes could be seen in the deviations of the actual B2B e-commerce applications from the original version held by senior management.

As outlined above, three knowledge processes have been identified to understand knowledge in IT-based innovations. The remainder of this chapter will review the relevant literature, which can be associated to each of the three knowledge processes. Due to the

exploratory nature of this research, the main aim is to link fragmented areas of research. Yet, it is acknowledged that this approach will not be able fully to explore each of the areas.

2.5 Knowledge Creation

One of the knowledge processes was knowledge creation which has been described as involving new content or replacing existing content within the organisation's knowledge (Alavi and Leidner, 2001). The aim of this section is to outline how organisations create knowledge in the context of IT-based innovations. First, different strategies to create knowledge for IT-based innovations are outlined. Then, the importance of sensemaking is discussed in which meaning is constructed for understanding technological development, use and change in organisations. Finally, the discontinuity of knowledge creation in IT-based innovations is detailed.

2.5.1 Strategies for Knowledge Creation in IT-based Innovations

Based on an in depth and longitudinal empirical study of seven IT-based innovations, Scarbrough (1995) identified three strategies by which organisational members coordinate and regulate the creation of knowledge for IT-based innovations: blackboxing, hostage, and prisoner strategy. The underlying assumption of the concept suggested by Scarbrough (1995) is that IT-based innovations such as B2B e-commerce can be depicted as a complex, multifaceted bundle of ideas and technical knowledge that needs to be acquired externally or generated internally. These ideas and knowledge can take various forms including technical artefacts, packaged software, human expertise, organisational routines and decision-making structures (Clark and Staunton, 1989; Scarbrough, 1995).

The blackboxing strategy refers to the acquisition of objectified artefacts such as off-the-shelf hardware and software packages. Latour (1987) argues that such objectified artefacts are developed by separating the knowledge from its original social and technical context

and by making it progressively stabilised, segmented and portable in order to recoup the development costs by exploiting its relatively low cost of reproduction and distribution. The advantage of the blackboxing strategy derives not only from the economic benefits in terms of lower cost and shorter development time over in-house IS development, but it also allows companies to use technology in areas where no previous organisational knowledge existed. The disadvantage, however, is that companies adopt objectified artefacts with very little understanding about the underpinning knowledge and complexity and so fail to apply the ideas, and experience a high level of implementation failure as a result (Swan and Clark, 1992; Wilson et al., 1994). The decision to pursue a blackboxing strategy depends on the perceived trade-off between the cheapness and readily available functionality of standardised packages and the potential misalignment between commodified knowledge and the organisational context.

The hostage strategy refers to knowledge acquisition through collaboration between a company and a supplier or consultant. Companies benefit from collaboration by having reduced development costs and the acquisition of a bespoke application. Suppliers and consultants, in turn, benefit from the experience gathered during the systems development, which could be used to develop a marketable blackboxed solution. Although the economic benefits for both sides can be considerable, Scarbrough (1995) has found that many reasons for successful knowledge trading derive from social relations rather than economic factors alone. Successful joint systems development relies heavily on the degree of trust, which a shared occupational identity helps to engender. By sharing similar occupational knowledge, each side has the expertise necessary to evaluate the other's work, which not only lubricates the coordination of work but also avoids opportunism (Scarbrough, 1995).

Whereas both blackboxing and hostage strategies involve knowledge acquisition from outside the organisation, the prisoner strategy refers to internal knowledge development and acquisition. By developing systems and applications in-house, the organisation can

secure exclusive control of innovation outputs in order to achieve competitive advantage. This is done in two mutually dependent ways. The first way is to create specific organisational knowledge about the new technology. During the development of the new technology, organisational members learn project specific skills and gain experience so that they become experts in this particular field. The prisoner strategy does not imply that the whole development is conducted in-house, but the use of standard packages, and subcontracting to external suppliers, is heavily constrained. In order to make this specific knowledge exclusive to the organisation, the second way involves forging strong employment relations that seek to bind experts tightly to the organisation. That can be achieved by offering a long-term and detailed career prospects within the company.

As the three strategies have indicated, organisations can draw on three sources to create knowledge for an IT-based innovation (Scarbrough, 1995). These sources are in-house expertise, supplier and consultancy expertise, and software packages. Although it is frequently suggested that organisations face a "make or buy" decision for the development of IT-based innovations (Lacity and Willcocks, 2000), it is rather a "make and buy" decision where the internal and external creation of knowledge appears jointly rather than discretely. Scarbrough (1995) identified the general relationship that the more standardised and less organisation specific the knowledge requirements of a particular IT-based innovation, the greater the role for sub-contracting and commodification of knowledge. However, similar IT-based innovations can be managed quite differently. In one pair of cases of IT-based innovation that were broadly similar in both technology and target market, and involved in both cases the purchase of a software package, one company chose to customise and maintain it entirely internally, while the other completely outsourced the development process (Scarbrough, 1995). This would suggest for the integration of B2B e-commerce that organisations might draw on different sources of knowledge even if they implement similar applications.

It has been argued earlier that B2B e-commerce is a complex and configurational innovation, which is relatively new and needs to be integrated with existing technical and organisational systems. Therefore it could be expected that the integration of B2B e-commerce depends on a complex admixture of in-house and external technological and human resources. Knowledge external to the organisation is needed to learn about new technology and the corresponding management principles behind B2B e-commerce. Here, suppliers and consultants appear to be an important knowledge source for the innovation process. At the same time, internal knowledge is needed to configure and adjust new technology to the specific organisational context. This requires not only the involvement of the IS department, but also the participation of those business functions whose practice will be affected by the innovation. It appears that the hostage strategy is the favoured approach to acquire knowledge, as technology vendors and consultants are likely to play an important role in helping the organisation to configure the standardised products to the organisational context.

2.5.2 Technological Frames

The process of constructing knowledge and meaning is based on the premises of technological frames (Orlikowski and Gash, 1994) and frequently referred to as "sensemaking" (Weick, 1990; Swan and Clark, 1992). Although technological frames and sensemaking have also been associated with knowledge sharing (Orlikowski and Gash, 1994) and retention (Stein, 1995), the construction of meaning in IT-based innovation is particularly relevant for knowledge creation as it is inseparably linked with the development of particular assumptions and expectations of technology (Orlikowski and Gash, 1994).

A major premise of this research is that people draw on guidelines or frames of reference which have been described as "a built-up repertoire of tacit knowledge that is used to impose structure upon, and impart meaning to, otherwise ambiguous social and situational

information to facilitate understanding" (Gioia, 1986, p.56). As Gioia (1986) argues frames include assumptions, knowledge and expectations, that can change over time and are expressed symbolically through language, visual images, metaphors, and stories. Frames typically operate in the background and can have both facilitating and constraining effects on the people's sensemaking and action. On the one hand, they are helpful in structuring organisational experience, allow interpretation of ambiguous situations, reduce uncertainty in conditions of complexity and change, and thereby provide a basis for taking action (Gioia, 1986). On the other hand, frames can be constraining when they reinforce unreflective reliance on established assumptions and knowledge and distort information to make it fit existing cognitive structures (Gioia, 1986). The concept of frames of reference is equally valid for individuals as for groups and organisations (Orlikowski and Gash, 1994). Shared frames can be created through social interaction such as professional and organisational socialisation, as well as group or departmental membership (Van Maanen and Schein, 1979).

Orlikowski and Gash (1994) developed the concept of technological frames to focus on the subset of organisational members' frames that are concerned with the assumptions, expectations, and knowledge in the understanding of technology. One important aspect of the concept of technological frames is the premise that a technological artefact may be interpreted differently by multiple social groups (Pinch and Bijker, 1987; Weick, 1990). Such interpretations, to varying degrees, are shaped and constrained by various groups' purpose, context, power, knowledge base and the artefact itself (Orlikowski and Gash, 1994). As Orlikowski and Gash (1994) suggest, groups can have congruent and incongruent technological frames. While congruence refers to the alignment of frames on key elements or categories such as similar expectations around the role of technology in business processes, incongruence implies important differences in expectations, assumptions or knowledge about key aspects of the technology. It has been found that critical social groups in the implementation of new technology including managers,

developers and users are likely to have incongruent technological frames that can lead to difficulties and conflicts around the development, implementation and use of technology (Swan and Clark, 1992; Orlikowski and Gash, 1994).

In an empirical study of people's interpretations of new groupware technology during the implementation, Orlikowski and Gash (1994) identified three core domains of the people's technological frames that were incongruent between technologists such as programmers and computer-support staff, and users such as employees and administrative staff. The first domain was the nature of technology, which refers to people's images of the technology and their understanding of its capability and functionality. Whereas technologists focused on the technological capabilities, users displayed a high degree of confusion about the use of technology. The second domain was the technology strategy, which refers to people's understanding of why the organisation acquired and implemented the new technology. Technologists saw the motivation as the achievement of major changes in the way of doing business, whereas users saw the motivation as facilitating incremental changes to the firm. The third domain was the technology in use, which refers to people's understanding of how the technology would be used on a daily basis. Technologists saw the new technology as an end-user tool with users taking the initiative to learn to use the technology on their own. In contrast, users saw the lack of understanding and training as an inhibitor for using the technology. Orlikowski and Gash (1994) argue that the incongruence of technologists' and users' technological frames resulted in users realising only a small part of the technological features.

In another empirical study investigating the role of technological frames in the implementation of EDI in the financial sector, Barrett (1999) identified three domains that were particularly relevant for the implementation of interorganisational technology such as B2B e-commerce. Barrett (1999) also found strong incongruence between IT professionals/senior management and users. The first domain was the nature of

technological change and refers to participants' perception of how work activities would change with the adoption and use of new technology. Whereas IT professionals and senior management associated the new technology with radical changes to work practices and culture, users anticipated incremental improvements to support existing practices. The second domain was the nature of business transactions, which refers to the participants' perception of key characteristics of business transactions and to what extent they may be supported by new technology. While IT professionals and senior management viewed transactions mainly as simple and standard, users believed that the majority of transactions involved high level of complexity and personal involvement. The third domain refers to the participants' perception as to how key market mechanisms for interorganisational cooperation, such as personal relationships and trust, may be undermined by the adoption of new technology. While users emphasised the importance of personal relations, IT professionals and senior management focused on the benefits of automating transactions. Barrett (1999) argues that the differences in technological frames led to low levels of adoption of the technology in the financial sector.

Previous research suggests that technological frames and differences in interpretation are critical elements for knowledge creation. Research indicates that different organisational groups are likely to have different technological frames which may impede the integration of B2B e-commerce. The domains suggested by Orlikowski and Gash (1994) and Barrett (1999) provide a valuable framework within which to identify interpretations about B2B e-commerce. Due to the pervasive characteristic of B2B e-commerce, the framework is likely to identify different organisational groups with incongruent technological frames that have different understandings about the purpose, capability and impact of B2B e-commerce.

2.5.3 New Technology and Interpretive Closure

So far, it has been implicitly assumed that sensemaking, and therefore knowledge creation, is a continuous process. However, research has shown that sensemaking of technology is not a gradual and ongoing activity throughout the IT-based innovation, but rather highly discontinuous (Barley, 1986; Tyre and Orlikowski, 1994; Ciborra, 1999). It is argued that assumptions, behavioural patterns and practices in the context of new technology are defined early and congeal quickly (Tyre and Orlikowski, 1994). This can be explained by the strong tendency of individuals and groups to create routine behaviour to simplify information processing needs and encountered complexity (Barley, 1986). There are only a few "windows of opportunity" for active problem-solving, information processing, modification of behavioural patterns and routines, during which intensive sensemaking among individuals and groups in organisations occurs (Tyre and Orlikowski, 1994).

A number of studies suggest that the point at which an organisation encounters a new technology is the one at which it is most susceptible to sensemaking (Weick, 1990; Griffith, 1999). It has been argued that while older technologies tend to have distinctive organisational implications underpinned with limited sensemaking and learning processes, the specific properties of new technology can trigger more challenging and ongoing sensemaking (Weick, 1990; Griffith, 1999). The first property of new technology is unpredictability, in that it presents a permanent source of uncertainty to users. Whereas traditional technologies were deterministic with clear cause-effect relationships and organisational consequences, new technology is the cause of randomly occurring and unpredictable outcomes. The second property of new technology is the continuity of processes enabled by technology. New technology such as communications technology has the potential to knit separate actors, transactions and locations together into a continuous process. The third property of new technology is that work is increasingly conducted by technology, so that people experience growing cognitive demands to

understand those abstract processes. New technologies are fundamentally dual in the sense that they involve the self-contained, invisible material process that is physical unfolding, as well as the self-contained, equally invisible imagined process that is mentally unfolding in the mind of an individual or a group (Weick, 1990).

However, such intensive sensemaking appears to fall off abruptly after a short initial introduction period (Tyre and Orlikowski, 1994). Tyre and Orlikowski (1994) identified two forces that can be directly linked to decline in sensemaking. First, people adapted themselves to the new technology. As people gained experience, they established stable routines, norms and habits for understanding and using the technology which decreased the need for conscious information processing and effortful decision-making. Hence, the patterns of use congeal quite rapidly in a matter of months and learning processes were limited. Second, expectations regarding the performance and capabilities of a new technology changed over time. Initial standards were lowered or interpretations amended to fit actual outcomes. In this way, problems and opportunities often disappeared from the view of the people involved. This suggests that active sensemaking decreases as new technology becomes more familiar and more embedded in the organisational context.

Tyre and Orlikowski (1994) also found that after the initial decline of sensemaking, unexpected events could trigger later spurts of re-examination resulting in new sensemaking. Such unexpected events included changes to the existing IT infrastructure, e.g. new software releases or addition of new hardware, that forced organisational members to refocus on the technology and its use. Re-examination was also triggered by the inclusion of new personnel or new management who questioned earlier choices and assumptions. Subsequently, unexpected events created opportunities for organisational members to review and revise their procedures and process. However, later sensemaking was limited in its duration and ability to change the understanding and use of the technology.

It can be argued that B2B e-commerce is unpredictable, as the technology is still evolving and the impact on both market structure and organisational business processes are unknown. Being an unpredictable technology, B2B e-commerce would require ongoing sensemaking and learning of people in the interaction with the new technology since it can change faster than people can accumulate knowledge about it (Weick, 1990). The continuity of processes is a key feature of B2B e-commerce that links previously separate internal organisational functions and external bodies such as suppliers. B2B e-commerce also puts increased cognitive demands on people as it replaces traditional ways of working and offers genuinely new ways for conducting business, such as B2B marketplaces. The problem with abstract processes is that a person's mental model of the new technology can be more easily decoupled from the physical process and thus result in misconceptions and misinterpretations (Weick, 1990). As the technology on which B2B e-commerce is based is still evolving, it could be expected that there be disruptive events such as new applications that trigger renewed sensemaking and prevent interpretive closure (Bijker et al., 1987).

2.6 Knowledge Sharing

A further process relevant to understand knowledge in IT-based innovations was knowledge sharing which refers to the distribution of knowledge among social communities (Alavi and Leidner, 2001). In this section, both social and ICT-based aspects of knowledge sharing will be outlined. First, the role of social communities in IT-based innovations, such as project teams and communities of practice, is discussed. Then the social aspect of knowledge sharing particularly between social communities within and across organisations, is outlined. Finally, the relevance of ICT for knowledge sharing is detailed.

2.6.1 Role of Social Communities in Knowledge Sharing

Knowledge sharing requires people with relevant knowledge and expertise to work together in social communities to share new ideas and external knowledge at a local level (Brown and Duguid, 1998). A social community can be a formal or an informal group of people, inside or outside the organisational boundaries, who are engaged in a relationship of some sort (Wenger and Snyder, 2000). The notion of social communities highlights the importance of relationships, shared understanding and attitudes to knowledge sharing. Although social communities have also been associated with knowledge creation (Orlikowski and Gash, 1994), they are particularly relevant in connection with knowledge sharing, as knowledge needs to be shared in order to create organisational knowledge (Brown and Duguid, 1998). As shown in Table 2.3, four types of social communities can be differentiated (Wenger and Snyder, 2000). In the remainder of this section, these four types are introduced in more detail, empirical findings are outlined and their potential role in the integration of B2B e-commerce is considered.

	Purpose	Members	Adhesive	Duration
Formal work group	To deliver a product or service	Employees who report to the group's manager	Job requirements and organisational structure	Until organisational restructuring
Project team	To accomplish a specific task	Employees assigned by senior management	Project milestones and goals	Until project completion
Social networks	To collect and pass on information	Friends and acquaintances	Mutual needs	As long as people have a reason to connect
Communitiy of practice	To develop members' capabilities; to build and exchange knowledge	Members who select themselves	Passion, commitment, and identification with group's expertise	As long as there is interest in maintaining the group

Table 2.3: Comparison of Social Communities (amended from Wenger and Snyder, 2000)

One form of social community is the formal work group, e.g. departments, that are part of the organisational structure. The task of the formal work group is to deliver a product or service such as the production of commodities on the shop floor or marketing services to increase sales. Formal work groups have been found critical to understanding the creation

of identity and thereby influencing the way knowledge is shared (Brown and Duguid, 1998). The socialisation of individuals into formal work groups involves the acquisition of particular identities held by different professional groups such as engineers or managers (Ibarra, 1999). Such identities determine both how an individual sees the world and how the world sees the individual. The existence of different identities has an impact on how knowledge is shared both within formal work groups and between different work groups. Formal work groups such as IS departments and business functions have been found to share knowledge extensively to develop a common understanding (Orlikowski and Gash, 1994). Knowledge sharing was based on social interaction such as conversations and meetings. However, knowledge sharing between formal groups has been found to be problematic due to different interpretations of new technology (Barrett, 1999).

Project teams present a further form of social community. Project teams are created by managers to accomplish a specific task and disband once the task has been completed. Cross-functional and interorganisational teams have been found to be important to share knowledge across functional and organisational boundaries, particularly where different groups had a different understanding of the innovation (Gibbons, 1994). In the context of IT-based innovations, project teams are a common feature in managing the roll out of new technology (Hallows, 1998). Wilson et al. (1994) found that it is important for knowledge sharing to engage actors with relevant knowledge in, for example, cross-functional implementation teams. However, knowledge sharing in cross-functional teams can be seriously impeded due to functional representatives' different agendas and understanding of the new technology (Hansen, 1999).

Social networks consist of friends and acquaintances and are held together by mutual needs as long as people have a reason to connect (Wenger and Snyder, 2000). Social networks have frequently been associated with knowledge sharing in IT-based innovations (Robertson et al., 1996; Hislop et al., 2000, Newell et al., 2000). A distinction is often

made between intra- and interorganisational networks with much of the network literature focusing on the latter (e.g. Alter and Hage, 1993; Grandori and Soda, 1995). Research in the field of IS diffusion has highlighted the importance of interorganisational networks that link a focal organisation and a variety of other organisations so that new ideas and knowledge can be shared across organisations (Rogers, 1995; Tushman and Scanlan, 1981). In addition to interorganisational social networks, intraorganisational networks have been found to provide a platform for sharing knowledge in organisations (Hansen, 1999; Hislop et al., 2000). Hislop et al. (2000) found that social networks including staff from different functions enabled members of a project team to access knowledge about internal products and organisation-specific processes. However, Hansen (1999) also found that although such networks helped a project team searching for knowledge from other sub-units, it impeded the sharing of more complex knowledge, which tended to require strong social relations between the two parties of transfer.

Communities of practice have increasingly attracted attention in the context of knowledge sharing and creation (Brown and Duguid, 1998; Wenger and Snyder, 2000). A community of practice can be defined as an informal activity system in which participants share understanding concerning their action (Lave and Wenger, 1991). Communities of practice are not exclusive to organisations but can involve members from different organisations (Brown and Duguid, 2001). Members of communities of practice select and organise themselves to overcome the limitations of the formal organisation (Brown and Duguid, 1998). Communities of practice allow people to share their knowledge in uninhibited and creative ways that may foster new approaches to problems (Wenger and Synder, 2000). Although recent literature draws attention to the manageability of communities of practice (Storck and Hill, 2000), it is difficult to develop them systematically and integrate them with the rest of the formal organisation (Contu and Willmott, 2000). Management activities are likely to interfere with or hinder the organic, spontaneous and informal nature of knowledge sharing among members (Brown and Duguid, 2001)

Previous research suggests that there is a variety of social communities that are important for knowledge sharing. Due to its pervasive innovation, B2B e-commerce is likely to affect different formal work groups such as business and IS departments. Here, this research needs to investigate how knowledge is shared across different departments. B2B e-commerce is also likely to be implemented by project teams that try to draw broadly on business and IT expertise. This research needs to analyse how knowledge is shared within a project team integrating B2B e-commerce. Previous research also draws attention to the importance of social networks and communities of practice. Both forms of social communities might be an additional platform for sharing knowledge in the integration of B2B e-commerce. In addition, different social communities are likely to be used to share knowledge about the integration of B2B e-commerce. It might be the case that certain social communities are used for sharing different bodies of knowledge.

2.6.2 Stickiness and Social Strategies of Knowledge Sharing

The previous section has demonstrated the importance of different social communities. Social communities develop forms of collective knowledge, shared sensemaking and distributed understanding (Brown and Duguid, 1998). The notion of knowledge embedded and distributed in social communities does not preclude the idea of personal, private knowledge. Tsoukas (1996) points out that individuals have not so much personal, modular knowledge but shared and partial knowledge. The distribution of knowledge in an organisation reflects the social division of labour, with professional groups holding highly specialised knowledge (Scarbrough, 1998). Brown and Duguid (1998) argue that different social communities with their own specialised knowledge develop their own endorsement mechanisms that show people what ideas and beliefs they should attend to and what to avoid. Based on von Hippel (1994), Brown and Duguid (1998) use the term "stickiness" to refer to the locally embedded nature and endorsement mechanism of knowledge.

There is a prevailing assumption in the field of knowledge management that once knowledge is identified, it can be transferred where it is needed (Grover and Davenport, 2001). Due to its social origins, knowledge is shared differently within communities than it is between them (Brown and Duguid, 1998). Within communities, knowledge is continuously embedded in practice and thus shared easily. Members of a community implicitly share a sense of what practice is and what the standards for judgement are. Zenger and Lawrence (1989) point out that the knowledge permitting sharing is based on shared language and symbols. Between communities, however, knowledge sharing becomes problematic as communities have different standards and ideas of what is significant. While the division of labour erects boundaries within organisations, it also produces extended social communities such as interorganisational networks or communities of practice that lie across the external boundaries of an organisation (Brown and Duguid, 1998). Knowledge sharing among groups with similar knowledge and overlapping membership can thus be easier, compared to the difficulty of sharing knowledge among heterogeneous groups within a firm (Kreiner and Schultz, 1993).

Similarly, Cohen and Levinthal (1990) argue that the ability to evaluate and share knowledge is largely a function of the level of prior related knowledge. Prior related knowledge confers an ability to recognise the value of new knowledge, assimilate it, and apply it to commercial ends. These abilities collectively constitute what Cohen and Levinthal (1990) call a firm's "absorptive capacity" which is a trade-off between commonality and diversity of knowledge. Commonality of knowledge refers to knowledge shared within a social community. Diversity of knowledge refers to dispersed bodies of knowledge held by different organisational groups that provide distinct sources for problem-solving. Cohen and Levinthal (1990) argue that there is a trade-off in the efficiency of sharing knowledge against the ability of organisational groups to assimilate and apply knowledge originating from other organisational groups or the environment. If there is a high degree of commonality, knowledge sharing is likely to be effective.

However, a high level of shared knowledge prevents them from being able to tap into diverse knowledge sources. While some overlap of knowledge across organisational groups is necessary for knowledge sharing, there are benefits to diversity of knowledge. Cohen and Levinthal (1990) suggest that organisations with higher levels of absorptive capacity will tend to be more proactive, exploiting opportunities presented in the environment, independent of current performance.

There are two main social strategies for promoting knowledge sharing between heterogeneous social communities (Cohen and Levinthal; 1990; Brown and Duguid, 1998). Different terms have been used such as "gatekeepers" (Allen, 1977) or "boundary spanners" (Tushman and Scanlan, 1981) to describe individuals who stand either at the interface of the organisation and the external environment or at the interface between sub-units within the organisation. Such individuals act as mediators who monitor the environment and translate new knowledge into a form understandable to the organisation or sub-unit (Macdonald and Williams, 1992). In their study of the implementation of manufacturing resource planning (MRP) in two large organisations, Swan et al. (1998) found that boundary spanning individuals are not simply communicating ideas but play a key role in articulating and constructing knowledge that is diffused via the networks in which they are involved. For boundary spanning individuals to become important for the IT-based innovation, they not only have to penetrate a variety of external networks, but they have also to be influential internally within their organisation (Tushman and Scanlan, 1981; Newell et al., 2000). Internal influence can be achieved either through having a formal position or function in the organisation of the IT-based innovation or through participating in relevant decision processes through informal contacts.

Boundary objects are another way to facilitate knowledge sharing by bringing social communities, intentionally or unintentionally, into negotiation (Brown and Duguid, 1998). Boundary objects are objects of interest to each community involved, but viewed or used

differently by each of them, such as physical objects, contracts or organisational processes. Social communities negotiate their different interests and priorities around the compelling need to share an interpretation of the boundary objects (Brown and Duguid, 1998). Shared interpretations are the foundation for knowledge commonality that enables knowledge sharing between diverse social communities. Through boundary objects, a community can come to understand what is common and what is distinct about another community.

Two areas are of particular interest for analysing knowledge sharing in IT-based innovations. First, this research needs to identify which social strategies were important during the integration of B2B e-commerce. Due to its pervasive innovation characteristics, the notion of B2B e-commerce can be understood as a boundary object that requires different social communities such as organisational functions to share knowledge. In addition, there might be boundary spanning individuals who link separate social communities. Second, the notion of absorptive capacity suggests that there is a trade-off between the commonality and diversity of knowledge. The research needs to investigate how this trade-off was achieved in the integration of B2B e-commerce.

2.6.3 Use of Information and Communication Technologies

Research and practice in knowledge management has been dominated by a focus on ICT to share and store knowledge within and across organisations (Davenport and Prusak, 1998). It has been argued that ICT such as intranets, databases and search engines can be understood as strategic knowledge management systems that improve performance or support innovation (Earl, 1999). Such technocratic approaches frequently define knowledge as the most valuable form of content in a continuum starting at data, encompassing information and ending at knowledge (Earl, 1999; Grover and Davenport, 2001). Raw data is transformed into usable knowledge as part of knowledge management initiatives and then transferred to other parts of the organisation where it is needed (Grover

and Davenport, 2001). Behind much of this work lies the positive notion of knowledge, which sees it as a definable entity that can be extracted and transferred.

The idea that knowledge can be shared via ICT has been hotly debated. In their study of ICT, Coombs et al. (1992) argue that information is both shaped by particular forms of knowledge when it is created and when it is received and interpreted. Thus information transmitted via ICT does not transfer knowledge, as the information content will be re-shaped through the subjectivity of recipient. Similarly, the notion that knowledge can be codified and transferred using ICT has been challenged for failing adequately to address the issue of tacit knowledge. Explicit knowledge which can be captured as information is grounded in an unarticulated background and loses its intrinsic meaning when it is transferred to a different context (Tsoukas, 1996).

As the discussion about social communities and networks indicated, knowledge sharing relies on fundamental social processes (Pentland, 1995). Such social processes are based on formal and informal mechanisms (Swap et al., 2001). Informal mechanisms include mentoring and storytelling whereas formal mechanisms include training sessions, meetings and workshops. In this light, the role of ICT in knowledge sharing is rather limited. ICT was found to support knowledge sharing rather than communication under two circumstances (Goodman and Darr, 1998; Jarvenpaa and Staples, 2000). First, users of ICT have a similar professional background and there is a high interdependence of users' tasks. Second, the information shared referred to simple problems and solutions that involved a low degree of tacit knowledge.

As the overall discussion indicates, ICT is likely to play an important role but not one that is necessarily positive or negative as it depends on social relations. The focus of the empirical part of this research needs to be on formal and informal social processes of knowledge sharing, such as meetings and casual conversation, rather than the use of ICT.

2.7 Knowledge Retention

Knowledge retention within the organisation refers to the capability of the social system to retain knowledge (Pentland, 1995). Alavi and Leidner (2001) also expand the idea of knowledge retention by including the retrieval of knowledge to support organisational activities. Frequently, the notion of "organisational memory" is used as a metaphor to describe this phenomenon (Weick, 1979; Huber, 1991; Walsh and Ungson, 1991; Stein, 1995). The aim of this section is both to outline how knowledge is retained in organisations and to identify research domains that are particularly relevant in the context of IT-based innovations. First, research in the field of organisational memory is outlined that suggests a number of knowledge retention facilities in organisations. Then, research emphasising the importance for IT-based innovations of human expertise retained in experts and specialist is discussed. Finally, recent research is outlined that draws attention to the importance of organisational routines for both retention and use of knowledge.

2.7.1 Knowledge Retention Facilities

One of the main questions in association with knowledge storage is how organisations retain knowledge. Several taxonomies for knowledge retention have been suggested (Walsh and Ungson, 1991; Blackler, 1995; Stein, 1995; Cross and Baird, 2000). These taxonomies agree on two fundamental features of organisational knowledge retention. First, they differentiate between individual and organisational levels of knowledge retention, and take physical artefacts into consideration. Second, rather than conceptualising retention facilities as separate entities, the taxonomies emphasise that organisational knowledge is distributed across different parts of an organisation and interwoven in the organisational system (Ackerman and Halverson, 2000). This confirms the constructivist notion of knowledge as illustrated earlier and adopted in this research. For this research, the taxonomy suggested by Stein (1995) presents the most systematic and extensive approach to distinguishing different retention facilities, which are depicted in

Table 2.4. Several mechanisms for knowledge retention within organisations have been proposed that can be classified into five major categories: schema, scripts, social and physical systems and information. The remainder of this section takes a closer look at these knowledge retention facilities.

Retention mechanism	Individual level	Collective level
Schema	Personal schema	Shared schema, e.g. cognitive maps, culture
Scripts	Personal routines	Operating procedures, routines, activity programmes
Social systems	N/A	Organisational structure, social networks
Physical systems	N/A	Buildings, equipment, products
Information	Personal files, notes	Shared databases, communications systems

Table 2.4: Knowledge Retention Facilities (amended from Stein, 1995)

Schema which are also referred to as frames or cognitive maps (Orlikowski and Gash, 1994) retain knowledge as cognitive structures that help people organise and facilitate information processing (Daft and Weick, 1984). Knowledge is in part retained in individuals' brain memory in the form of belief structures, cause maps, assumptions and values (Walsh and Ungson, 1991). As outlined earlier, Orlikowski and Gash (1994) focused on technological frames to examine the underlying assumptions and knowledge that people have about technology as part of knowledge creation. Schema can be found on both individual and collective levels. On a collective level, individuals can share common schema that maintain the values, norms and images of the organisation (Orlikowski and Gash, 1994). Shared schema have been referred to as mental models (Argyris and Schon, 1978) and culture (Walsh and Ungson, 1991). Organisational culture can be defined as a learned way of perceiving, thinking and feeling about problems that is transmitted to members in the organisation (Schein, 1984). Culture retains past experience that underlies organisational interaction. Cultural knowledge is stored in language, shared frameworks, symbols and stories and it is continually enacted (Walsh and Ungson, 1991).

Scripts are another means to retain knowledge in organisations. Stein (1995) refers to scripts as knowledge about the appropriate sequencing of events in conventional or familiar situations that have been formulated by design. Scripts are often associated with organisational routines which are repeated, and relatively stable patterns of behaviour that are bound by rules and customs (Cohen and Bacdayan, 1994; Feldman, 2000). On an individual level, personal routines have been found to be important forms of procedural memory, active in operations (Nelson and Winter, 1982). Similarly, individual roles can be considered scripts as they encode a particular set of behaviour based on social expectations (Walsh and Ungson, 1991). Collective scripts involve shared scripts that lead to coordinated activities that apply to all collective transformations that occur in organisations (Walsh and Ungson, 1991). Such activities have been described as organisational routines (Nelson and Winter, 1982) and standard operating procedures (Cyert and March, 1963; Weick, 1979).

Knowledge is also stored in the social fabric of organisations. Formal organisational structure holds knowledge reflecting the specific organisational environments, goals and values as well as reporting channels (Stein, 1995). Organisational structure also presents a framework for individual role behaviour that depicts task differentiation and control (Walsh and Ungson, 1991). In addition, social networks can hold relational knowledge that directs individuals to those who can support problem-solving and decision-making (Stein, 1995). Individuals not only retain knowledge in their memories but they also keep a directory of the existence and location of knowledge held by external sources (Anand et al., 1998; Cross and Baird, 2000). Such external sources consist of knowledge that is not personally known by individuals but which can be retrieved when required. Here, personal relationships with colleagues and friends strongly facilitate identification of and access to external sources (Anand et al., 1998). This confirms the important role of social communities, such as communities of practice, for the retention of knowledge.

Physical systems are a further mechanism for the storage of knowledge. Knowledge can be retained in buildings, especially in their physical work layout and the allocation of space to particular individuals or groups (Clark and Staunton, 1989). The physical setting often reflects status and hierarchy in an organisation that helps to shape and reinforce behavioural prescriptions within an organisation (Walsh and Ungson, 1991). Equipment is another form of a physical system that can retain knowledge (Clark and Staunton, 1989). Equipment can be distinguished into a physical system that transforms material into a different state, transfer material between workstations and control either the transformation or the transfer (Clark and Staunton, 1989). Products and services can also be seen as preserving organisational knowledge (Stein, 1995). For example, software packages implicitly hold the design and development knowledge of the organisation that created the product or service (Scarbrough, 1995).

Finally, Stein (1995) argues that organisational knowledge can be stored in records holding encoded knowledge that is stored spatially and in a medium that persists in time. More recently, it has been argued that ICT such as databases or knowledge repositories can be used to support knowledge storage (Stein and Zwass, 1995; Wijnhoven, 1999). According to this view, specialised knowledge is codified and converted into electronic files that can be saved and shared with current or future organisational members (Stein and Zwass, 1995). This view of knowledge storage reflects the positivist notion of knowledge as being an objective commodity. Similarly to the discussion about the role of ICT in knowledge sharing, recipients need to possess the unarticulated background to understand these representations (Tsoukas, 1996). Therefore, records can only play a very limited role in storing and reproducing knowledge. It has been found in the study of organisational memory development in 22 projects in large organisations that records are a complement to rather than a substitute for knowledge storage, as records can work as reminders of previous events or activities (Cross and Baird, 2000).

The literature has shown that knowledge related to the integration of B2B e-commerce can be stored in different ways. As the discussion of technological frames for knowledge creation has shown, schema will be one important retention facility for individuals and groups. Due to its transformational characteristic, B2B e-commerce is likely to change individual and collective scripts by introducing new business processes to the organisation. Such changes might also be reflected in alterations to social systems in the form of new organisational structures. As B2B e-commerce involves the introduction of new technology, knowledge is likely to be stored in artefacts such as IT hardware and software configurations. It can also be assumed that individuals and groups keep records about the implementation process such as project documentation or presentations. The empirical analysis in this research needs to reveal which, and to what extent, different retention facilities are affected during the integration of B2B e-commerce.

2.7.2 Importance of Professionals in IT-based Innovations

The findings of much of the literature on IT-based innovations implies that much of the knowledge necessary to the integration of new IT is embodied in people and not codified in a disembodied way (Hislop et al., 2000; Markus, 2001). The importance of people for retaining knowledge is reflected in the recent debate about organisational professionals or the so called "knowledge worker" (Tjaden, 1996; Davenport et al., 1996; Scarbrough, 1999). Organisational professionals such as the central R&D or IT function are individuals who are committed to professional standards and whose work practices are dependent on specialised learning and abstract knowledge (Scarbrough, 1999). Professional knowledge is acquired through education and socialisation and subject to professional norms and controls. Knowledge workers have been defined as professionals who apply high levels of abstract and specialised knowledge to the interpretation of information and production of goods and services (Tjaden, 1996). In comparison to organisational professionals, knowledge workers are not bound to the functional distribution of knowledge (Scarbrough,

1999). On this basis, a number of different groups have been labelled as knowledge workers. For example, Reich (1991) classifies organisational professionals as "problem solvers" such as R&D experts and designers, "problem identifiers" such as marketing and advertising professionals, and "brokers" such as financiers and contractors.

Organisational professionals and knowledge workers have been found as the main holder of knowledge for IT-based innovations. In their essay to stimulate IS specialists' efforts to become more effective, Markus and Benjamin (1996) point out that IS specialists, managers, executives and users are instrumental for IT-based innovations. Recent discussion reflects the notion of knowledge worker in the context of IT-based innovations. Markus and Benjamin (1996) argue that IS specialists need to become change agents because the implementation of new IT requires significant organisational change. By adding change management skills to their professional knowledge, IS specialists would gain organisational credibility. A similar notion is reflected in the concept of "hybrid managers". Hybrid managers are people with strong technical skills and adequate business knowledge who can work in user areas doing a line-functional job, but adept at developing and implementing IT applications areas (Earl, 1989). Skyrme (1996) argues that the essential attributes for hybrid managers are business knowledge, IT knowledge, knowledge about organisational processes and management qualities. Hybrid managers can be understood as knowledge workers because they bridge the cultural gaps which can exist between the IS and other business functions (Currie and Glover, 1999).

The notion of organisational professionals and knowledge workers as the dominant holders of knowledge has been strongly criticised. Argyris (1991) argues that people at all levels of the organisation must combine the mastery of some highly specialised expertise with the ability to work effectively in teams, form productive relationships with clients, and critically reflect on and then change their own organisational practice. Thus, knowledge is not exclusive to some individuals. A further criticism is related to the assumption that

crucial knowledge lies with individuals which largely ignores the distributed and embedded nature of knowledge (Blackler, 1995). As the outline of knowledge retention facilities has demonstrated, a firm's knowledge is distributed and embedded in different social communities and is part of organisational processes and routines (Boland and Tenkasi, 1995). Blackler (1995) even argues that in some organisations, the specialist knowledge of individuals may be much less important than knowledge embedded into structures, routines and procedures.

This discussion has shown the importance of organisational professionals or knowledge workers for retaining knowledge in the context of IT-based innovations. It can be expected that organisational professionals will play an important role during the integration of B2B e-commerce. This research needs to investigate two issues in particular. First, those organisational members need to be identified who retain knowledge during the integration of B2B e-commerce in the organisation. As B2B e-commerce is a pervasive innovation, knowledge is likely to be distributed among organisational members in different departments, who include managers and users. Second, the research needs to analyse what bodies of knowledge those professionals retain. With B2B e-commerce being a configurational innovation, professionals are likely to retain different bodies of knowledge such as business and IT knowledge to facilitate the integration process.

2.7.3 Organisational Routines

The previous section emphasised the importance of organisational professionals or knowledge workers in IT-based innovations. Yet an exclusive focus on individuals would neglect the importance of other knowledge retention facilities on a collective level. This research has already outlined collective schema as part of the discussion on technological frames. Equally, social systems have been detailed in the role of social communities. An area which needs further exploration, is collective scripts, most importantly organisational routines, as they have attracted considerable attention. In the field of organisational

strategy, the resource-based theory asserts that long-term superior performance is associated with the possession of firm-specific knowledge that is reflected in scarce and inimitable capabilities such as organisational routines (Quinn, 1992; Hamel and Prahalad, 1994; Grant, 1996a). While the notion of knowledge adopted by such research has been criticised as naively positivistic and mechanical (Spender, 1996), it nevertheless draws attention to organisational routines that link existing practice to organisational activity. In the context of knowledge processes, organisational routines can be understood as both a means of retaining and of utilising knowledge.

Research has recognised organisational routines as major source of the reliability and speed of organisational performance (Cyert and March, 1963; Nelson and Winter, 1982). Pentland and Rueter (1994) point out that there is a significant difference in the way organisational routines are defined. Earlier concepts of organisational routines emphasised the idea of a fixed response to a given stimulus. Nelson and Winter (1982) define organisational routines as relatively complex patterns of behaviour triggered by initiating signals in an automatic fashion. More recent research contests the notion of automatic response and, instead, sees organisational routines as effortful accomplishments (Pentland and Rueter, 1994). Pentland and Rueter (1994) points out that an organisational routine is not a single pattern but a set of possible patterns, enabled and constrained by a variety of organisational, social, physical and cognitive structures, from which organisational members enact particular performances. This suggests that organisational members have a repertoire of action that they can take, rather than being limited to a single response.

As the outline of knowledge storage facilities above has already indicated, organisational routines are frequently seen as a means to retain organisational knowledge (Walsh and Ungson, 1991; Stein, 1995). In their experimental study of the development of performance patterns, Cohen and Bacdayan (1994) identify three basic characteristics of organisational routines that help in understanding how knowledge is retained. First,

organisational routines involve multiple actors who are linked by relations of communication and authority. Though they are organised by such relations, the actors may have heterogeneous objectives, capabilities, or interpretations of events. Hence knowledge is distributed in social systems (Tsoukas, 1996). Second, organisational routines often emerge through gradual multi-actor learning. Organisations provide fertile conditions for the evolution of behavioural patterns by experiential learning rather than explicit decision-making. Third, the underlying knowledge of organisational routines is often inarticulate. Routines reside partially in what Cohen and Bacdayan (1994) call the "organisational unconscious", which makes it difficult to observe and analyse them.

Routines have an important role in patterning the behaviour of organisations by allowing the organisation rapidly to transfer that experience to new situations (Pentland and Rueter, 1994). The benefit of organisational routines is the ability to develop a short-term organisational responses to familiar and unfamiliar environmental stimuli by decreasing the effort spent on decision-making. Individuals develop sequential patterns of interaction which permit the integration of their specialised knowledge without the need for communicating that knowledge (Feldman, 2000). Cohen and Bacdayan (1994) argue that while routines allow efficient coordinated action, they also introduce the risk of highly inappropriate responses when applied in inappropriate situations.

Although organisational routines are associated with relative stability over time, they can change both because of external and internal transitions (Feldman, 2000). External transitions such as change of organisational context or the introduction of new technology are important motivations to change organisational routines. In the context of IT-based innovations, Orlikowski (1993) found that technological change is one explicit impetus that brings about changes in the way an organisation structures the accomplishment of work. In addition, internal transitions can equally change organisational routines. Feldman (2000) argues that change occurs as a result of participants' reflections on various

outcomes of previous iterations of the routine. Such changes of routine are influenced by both the organisational context and the action of participants who create and engage in conflict to enact routines.

Although the discussion of organisational routines indicates that they are important for both the retention and utilisation of knowledge in organisational practice, there is no substantial body of empirical research in the context of IT-based innovations. However, it appears that organisational routines may play an important role for the integration of B2B e-commerce in two ways. First, organisational routines are likely to influence how an organisation responds to unfamiliar environmental stimuli such as the introduction of B2B e-commerce. Such organisational routines could be the way projects are managed or the use of standard IS development methodology. Second, organisational routines are also a means of retaining knowledge in the form of organisational scripts. Due to its transformational innovation characteristics, B2B e-commerce has the potential to change organisational routines to reflect the pervasive use of new technology in different departments. Hence, this research needs to investigate how organisational routines influenced the integration of B2B e-commerce and whether they changed as a result of it.

2.8 Summary

The aim of this chapter was to draw on existing literature in order to develop an analytical framework for the analysis of knowledge management in IT-based innovations. To start with, key terms were defined to lay the conceptual foundations for this research. IT was defined as being an "equivoque" that is socially constructed, and related to time and context, as well as being provisional and dynamic (Weick, 1990; Orlikowski and Iacono, 2001). Knowledge is understood to be socially constructed and socially mediated. It is specific to time and context as well as embedded in action (Blackler, 1995; Tsoukas, 1996). B2B e-commerce was defined as "all activities between businesses, whether resulting in monetary transactions or not, that generate value both within a firm (internally)

and with suppliers and distributors (externally), occurring over networks such as the Internet which use an open, non-proprietary standard" (OECD, 1999a, p.28,29). The integration of B2B e-commerce presents an opportunity to research knowledge in IT-based innovation, as it requires organisational groups to make sense of new IT, share their knowledge and integrate new knowledge to change existing technical and social systems.

The literature review revealed that there is a need to develop an analytical framework to understand knowledge in IT-based innovations. While process research on IT-based innovations such as the innovation episode framework (Clark et al., 1992) reflects the processual nature of IT-based innovations, it fails to place knowledge centre stage in its analysis. In contrast, research in the field of knowledge management suggests frameworks focusing on knowledge processes such as knowledge creation, sharing and retention, to analyse knowledge in organisations (Pentland, 1995; Alavi and Leidner, 2001). Still, such frameworks have not been applied in the context of IT-based innovations. By linking both frameworks, this chapter attempts to develop a new analytical framework to analyse knowledge in IT-based innovations, as shown in Figure 2.3. Whereas the innovation episodes draw attention to purposeful activities in IT-based innovation, knowledge processes provide the analytical perspective.

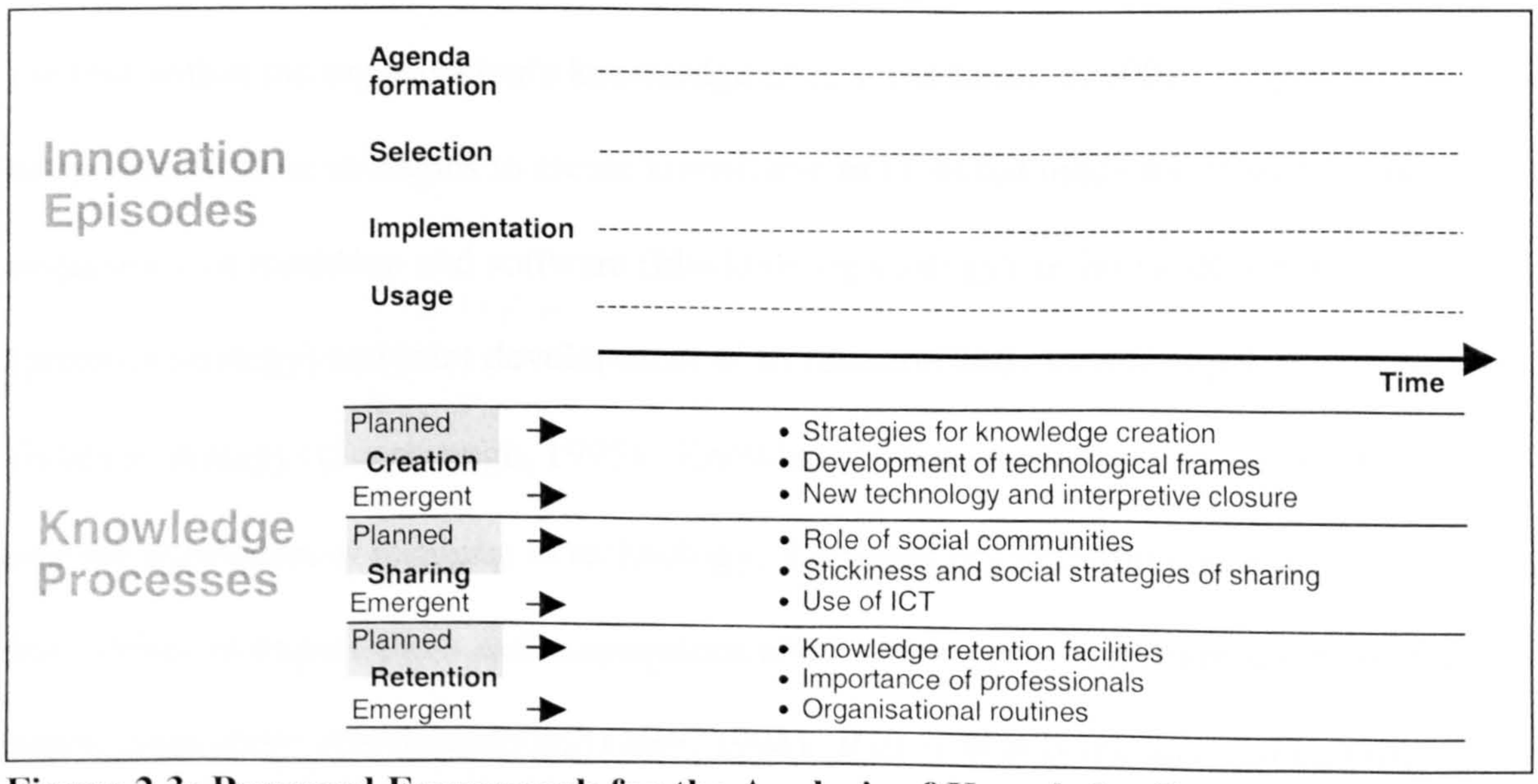


Figure 2.3: Proposed Framework for the Analysis of Knowledge Processes in IT-based Innovations

One important general principle that needs to be incorporated in the developed analytical framework is the question of whether and how knowledge in IT-based innovations can be managed. Although most literature on knowledge management reflects the classic formulation of management as planning and controlling knowledge, knowledge can only be managed through creating an organisational context that encourages and values knowledge creation, sharing and retention (McDermott, 1999; von Krogh, 1998). With reference to the developed analytical framework, two findings are of particular relevance. First, knowledge processes can be both planned, e.g. a result of managerial initiatives, and emergent, e.g. a result of ongoing improvisation by organisational members (Nidumolu et al., 2001). Second, the trajectory of IT-based innovations is likely to be influenced by technological drift rather than management control (Ciborra et al., 2000). Overall, the manageability of knowledge is closely related to power, which pervades all action in an organisation (Walsham, 1993). Issues of power and conflict can seriously affect knowledge processes and the trajectory of IT-based innovation (Coombs et al., 1992).

The remainder of the literature review focused on issues that appeared to be most relevant to understanding each of the three knowledge processes in the context of IT-based innovations. Knowledge creation involves developing new content or replacing existing content within the organisation's knowledge (Alavi and Leidner, 2001). Organisations can adopt one of three strategies to create knowledge in IT-based innovations such as the acquisition of hardware and software (blackboxing strategy), in-house development (prisoner strategy) and joint development of IS function and external supplier or consultant (hostage strategy) (Scarbrough, 1995). Knowledge creation involves social construction and the attribution of meaning to technology. Different organisational groups are likely to have different expectations and assumptions about key aspects of technology, impeding IT-based innovations (Orlikowski and Gash, 1994). Rather than being an ongoing process, it

suggests that knowledge creation is most intense when organisations encounter new technology, and then congeals quickly (Tyre and Orlikowski, 1994).

Knowledge sharing refers to the exchange of knowledge among social communities (Alavi and Leidner, 2001). Social communities include formal work groups, project teams, social networks and communities of practice (Wenger and Snyder, 2000) all of which have been found important in IT-based innovations. While knowledge sharing among social communities with collective knowledge and distributed understanding is relatively easy, knowledge sharing between different social communities has been found to be problematic due to the locally embedded nature of knowledge (Brown and Duguid, 1998). The use of ICT for knowledge sharing is highly limited as knowledge loses its intrinsic meaning when it is codified and transferred electronically (Coombs et al., 1992).

Knowledge retention refers to the capability to store and transmit knowledge from the past to future members of the social system (Pentland, 1995). There are several mechanisms for knowledge retention within organisations such as schema, scripts, social and physical systems and, to a limited degree, information (Stein, 1995). On an individual level, professionals such as IS specialists are important for retaining knowledge in the context of IT-based innovations (Currie and Glover, 1999). On a collective level, organisational routines are a means for both retaining and utilising knowledge in new circumstances (Feldman, 2000).

The preliminary analytical framework delineated in Figure 2.3 will guide the empirical element of this research. The next step for this research is to adopt an appropriate methodology that incorporates the notion of knowledge adopted here.

3. Methodology

3.1 Introduction

The purpose of this section is to discuss the paradigmatic assumptions on which this research is based and to justify the epistemological and methodological approach selected. For this research, an interpretive case study approach was taken using hermeneutic analysis to investigate the management of knowledge in integration of B2B e-commerce. Initially, the research is located in the qualitative tradition and the argument is made for adopting a case study method. Then, the theoretical foundations and principles of interpretive research are outlined and the rationale is presented for using an interpretive approach. Following this, the research design is detailed and the way data was collected and analysed is described. This section concludes with a summary in which the researcher reflects on the research process.

3.2 Qualitative Research

At the outset of empirical investigation, the researcher has to make a fundamental choice between taking a qualitative or quantitative approach. While a quantitative approach emphasises the measurement and analysis of causal relationships between variables, a qualitative approach stresses the value of rich descriptions of the social world (Denzin and Lincoln, 1994). Although a quantitative approach has been used to investigate knowledge in organisations, e.g. to measure the intensity of "knowledge flows" (Grant, 1996b), the majority of existing research has used a qualitative approach to deal with the inherent complexity and social nature of knowledge (Alavi and Leidner, 2001). In this section, the case is made for the use of a qualitative approach for this research and the characteristics and problems of qualitative research are briefly outlined.

3.2.1 Choice and Characteristics of Qualitative Research

The first step for developing a methodology is to decide on the fundamental question whether to adopt a quantitative or qualitative approach. In the literature review, paradigmatic assumptions about the nature of knowledge were made. The definition of knowledge for this research highlights the vital role of context and social constructions. In addition, the analytical framework emphasises the importance of process to understand IS implementation and the management of knowledge.

In their comparison between quantitative and qualitative research, Denzin and Lincoln (1994) make the point that qualitative research implies an emphasis on process and meanings that are not rigorously examined or measured. Qualitative researchers are able to stress the socially constructed nature of reality and seek answers to questions that emphasise how social experience is created and given meaning. Equally, Guba and Lincoln (1994) argue that the tools of quantitative research methods cannot adequately enable the researcher to understand process, context and authenticity.

In contrast, quantitative research often requires reducing complex phenomena to measurable indices and, in this process, imposes restrictions on respondents' ability to express precisely what they believe or understand, and inevitably misses out on nuance and subtlety (Guba and Lincoln, 1994). Denzin and Lincoln point out that quantitative research stresses the measurement and analysis of causal relationships between variables, not processes. Quantitative research is highly structured and does not allow the researcher to adapt or follow new lines of enquiry if they look promising. Only in qualitative research, the nature of the research question can be refined during the research if the evidence collected to date shows, for example, that the wrong question is being asked.

A qualitative approach appears to be appropriate for this research, as it emphasises the importance of process, context and social construction. Bryman (1988) identifies four key

characteristics of qualitative research. First, qualitative research enables the researcher to perceive events, to some extent at least, from the perspective of the insider, giving a very different picture from the perception of it from a distance. Contact will yield a strong sense of how things actually work. Second, a qualitative study allows an understanding of the context and the peripheral, but potentially important, factors that may impact on the research findings. By being there, the researcher may observe subtle influences on the process under study that may be impossible to see otherwise. Third, qualitative research places an emphasis on processes that occur over time. It is possible to conceive of this being done in a quantitative way, but any such method is likely both to be complex and to have severe limitations. Fourth, a qualitative study treats the subject, e.g. in the case of this research, an organisation, as a dynamic entity that is socially constructed and active and not as something that is "out there" and rigid. The relationship between the organisational members and their environment is easily lost in quantitative research.

Mintzberg (1979) supports this view and points out that the role of the researcher is to build theory from being close to the subject of study. Theory building requires richness and the richness comes, inter alia, from the anecdote. Van Maanan (1979) puts it a slightly different way, asserting that "doing" description is the fundamental act of data collection in a qualitative study. He too emphasises that qualitative research views reality as a social construction, not a concrete structure. Likewise he asserts, organisational members usually do not have the time to contemplate the deeper meaning of what they are doing. They react and respond. The task of understanding is down to the researcher who will not get sufficient data for this from a sample survey or the study of an annual report.

Guba and Lincoln (1994) differentiate between four alternative inquiry paradigms in qualitative research: positivism, postpositivism, critical theory and constructivism. In the literature review, it was argued against a positivist and postpositivist understanding of IT and knowledge, which tends to dominate current research. Instead, this research stresses

the role of social construction for the understanding of IT and knowledge. While the ontological position of critical theory still assumes a degree of apprehendable reality, only constructivist inquiry paradigm acknowledge that realities are apprehendable in the form of multiple, intangible mental constructions, that are specific to a context and dependent for their form and content on the individual persons or groups holding the constructions. Therefore, this research adopts a qualitative approach positioned in the constructivist inquiry paradigm.

3.2.2 Problems in Qualitative Research

Guba and Lincoln (1994) point out that there are many defensive attitudes to adopting qualitative research methods. In part this reflects the implicit dominance of the positivist paradigm and the success of this in scientific research. This dominance is mirrored in IS research (Orlikowski and Baroudi 1991). There are practical and theoretical problems, common to all qualitative research, that a researcher contemplating a qualitative approach needs to be aware of.

One potential problem is the generation of theory. Strauss and Corbin (1994) define theory as plausible relationships proposed amongst concepts and sets of concepts. Walsham (1995) argues that in practice much qualitative and even quantitative theory in the social sciences is about seeing and forecasting tendencies, which is particularly the case with theories of organisational behaviour. Theory generation in qualitative research has been described as the abstraction of concepts from rich data, kaleidoscopic reading and the ability to apply abstraction skills to qualitative data (Pettigrew, 1997). Mintzberg (1979) states that theory emerges from detective work and a creative leap. Theory appears to emerge from the mists of data. However, there is a risk that various rich threads of ideas converge too quickly, to form premature theories based on insufficient evidence (Van Maanen, 1979). All of this is quite different from the positing of an hypothesis and the devising of a specific instrument to test it, commonly adopted in quantitative research.

Another problem is the interpretation of the data. In a quantitative study, there are well established methods for both the research design, be it sample or experimental design, and for inference of conclusions from them. The semi-structured or unstructured nature of qualitative research on the other hand makes it difficult to analyse what may be a large amount of data into a coherent body of research material or extract any theoretical insights. Schandt (1994) talks of 95 per cent perspiration and 5 per cent inspiration. Data analysis methods leave a strong impression of ad hoc techniques (Huberman and Miles, 1994). Coding, data displays, matrices, linking, pattern matching, tabulations etc. may be enlisted to help, but in the final analysis, the process of insight has to forge new concepts in the deepest recesses of the human psyche. Charts, categorisations, etc. are valuable props and may well help to convey the outcome to others, but the essential process of extracting theory from rich data remains deeply mysterious. This is particularly so in interpretive research. This piece of research applies hermeneutic analysis, which is outlined in more detail further below.

3.3 Case Study Method

A research method describes a flexible set of guidelines that links the theoretical paradigms to research design and data collection (Denzin and Lincoln, 1994). In that way, the research method connects the researcher to specific methods of collecting and analysing data. Research methods tend to be linked to a specific body of literature illustrating history, exemplary works and preferred ways of putting research methods into practice (Denzin and Lincoln, 1994). This section will justify the choice of case study method for this research.

Case study research is a highly versatile method to investigate phenomena. It can be carried out in a positivist and interpretive tradition, can take a deductive or an inductive approach, can use qualitative and quantitative methods and can investigate one or multiple

cases (Cavaye, 1996). In general, the case study method is considered to be an effective means of collecting qualitative data within an organisational context (Mumford et al., 1985; Boland and Hirschheim, 1987; Benbasat et al., 1987; Yin, 1994; Galliers, 1992; Walsham, 1995; Darke et al., 1998). The case study method is the most widely used qualitative research method in IS research (Orlikowski and Baroudi, 1991; Myers, 2002) and innovation research (Slappendel, 1996; Van de Ven and Poole, 1995). Case study research has been used within both the positivist and the interpretive philosophical traditions (Cavaye, 1996; Darke et al., 1998; Myers, 2002). Yin (1994) and Benbasat et al. (1987) are strong advocates of positivist case study research and this approach has been used in a number of studies (e.g. Eisenhardt, 1989; Van de Ven and Poole, 1995). In contrast, Walsham (1995) advocates interpretive case study research, which has informed a number of studies (e.g. Walsham and Waema, 1994; Myers, 1994a).

It has been argued that there is no generally accepted definition of case studies (Benbasat et al., 1987; Gable, 1994; Yin, 1994). However, it is possible to list its characteristics (Cavaye, 1996). The case study method "does not explicitly control or manipulate variables; studies a phenomenon in its natural context; studies the phenomenon at one of a few sites; makes use of qualitative tools and techniques for data collection and analysis." (Cavaye, 1996, p.229) These characteristics are reflected in the general definition offered by Yin (1994), who is primarily associated with case study research in organisational studies. Yin (1994) defines a case study as "an empirical enquiry that investigates a contemporary phenomenon within its real-life context; especially when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used" (p.13).

The characteristics and the definition draws attention to the two major strengths of the case study method. One major strength of case study research is its focus on the in-depth understanding of a phenomenon in its context (Yin, 1994, Benbasat et al., 1987, Cavaye,

1996). Case study research investigates predefined phenomenon, but it does not involve explicit control or manipulation of variables and the testing of superficial theories (Cavaye, 1996). The emphasis of the case study lies in understanding the phenomenon rather than finding an explanation (Gable, 1994). The attention to context is especially important for this research, as knowledge is situated in time and embedded in context. Hence, this is one reason why case study research appears to be a suitable method for this research.

The other major strength of case study research is its reliance on multiple sources of evidence such as interviews, observation and document analysis (Yin, 1994). In addition, case studies employ multiple methods of data collection to gather information from different entities, e.g. people and groups in organisations (Benbasat et al., 1987). In the context of this research, multiple methods of data collection and sources of evidence are imperative to investigating knowledge, in order to gain an understanding of different expectations and assumptions of the integration of B2B e-commerce.

However, there are disadvantages associated with the use of the case study method. The data collection and data analysis processes in case study research are both subject to the influence of the researcher's characteristics and background, and rely heavily on the researcher's interpretation of events, documents and interview material (Galliers, 1992). From an interpretive perspective, bias might affect credibility and transferability of research findings (Guba and Lincoln, 1994). A further disadvantage is that the volume and variety of data collected may make analysis time-consuming and difficult (Miles and Huberman, 1994; Cavaye, 1996).

In general, the case study method has been found to be well suited to understanding the interactions between IT-based innovation processes and organisational context (Darke et al., 1998). Case studies have also been found particularly appropriate for the study of information systems development, implementation, and use within organisations (Benbasat

et al., 1987; Myers, 2002). More specifically, case study research is an appropriate method when one of four characteristics of the research area is applicable, e.g. where there is little understanding of how and why processes and phenomena occur, where the experience of individual and the context of action is critical, where a phenomenon is dynamic and new, and where theory is not yet clear and accepted (Darke et al., 1998; Benbasat et al., 1987, Yin, 1994). In the case of this research, case study research is appropriate for all four reasons. In addition, the literature review has shown that implementation of web-based technology is a young and not yet mature research area. It also became apparent that there is very little understanding or coherent theory of knowledge processes in the context of IT-based innovation. For all these reasons, the case study has been chosen as the preferred research method.

3.4 Interpretive Research – Theoretical Foundations and Principles

It has been noted that the case study can accommodate a variety of different philosophies and techniques. Orlikowski and Baroudi (1991) and Klein and Myers (1999) identify a number of different strands that can be undertaken within a case study framework, such as action research (Baskerville and Wood-Harper, 1996), ethnography (Van Mannen, 1979; Zuboff, 1988) and grounded theory (Glaser and Strauss, 1967; Orlikowski, 1993). In this section, the case is made for adopting an interpretive case study approach, by arguing for the acceptability of interpretive research in IS, outlining its ontological and epistemological assumptions and introducing a set of principles that ought to guide the empirical investigation.

3.4.1 Acceptability of Interpretive Research

In an assessment of the status and acceptability of interpretive research, Walsham (1995) applies Latour's (1987) rule of method for establishing the scientific claim of a research method. The first step in the rule is to establish its current status. According to Walsham, (1995), interpretivism is now taken seriously in the IS methodology literature. This can be

seen in the editorial policy statements of leading journals such as MIS Quarterly. A special issue of the Journal of Information Technology on interpretive research was published in December 1998.

The second step is to assess whether people are using the method for research that is being accepted within the research community. Within the family of case study research methods, the interpretive method has been steadily growing in popularity over the past decade. This progress has been documented by Walsham (1993, 1995) up to 1995 and more recently by Klein and Myers (1999). Evidence of the increasing acceptability of interpretive research can be seen in the increasing volume of reported IS research which uses this method, in the maturing discussion of this type of research in the research methodology literature, and in the editorial policies of leading journals (Chan 2000).

The third step in Latour's rule of method is to consider the opponents of a method. Although there are few explicit opponents of the interpretive method in the IS community, the dominant position of positivist research in the literature and the journals is, however, an implied criticism of interpretive methods. Latour describes the concept of a "machine", something akin to Kuhn's (1962) concept of a dominant paradigm. The machine is a mechanism whereby all research in a given area is kept within permitted boundaries of thought. A machine may be a laboratory, a journal or a community. Until the late 1980s, in the US at least, a number of leading journals only accepted positivist research (Galliers, 1993). In the IS community, positivism has the status of what Latour terms "tacit knowledge", e.g. results based on this method do not require the method itself to be defended afresh every time.

The final step in Latour's method is to assess the direction of change. Here there is increasing evidence of the acceptance of interpretive methods. The limits of traditional laboratory and statistical methods in IS research become very visible once one starts to

research the relationship, role and impact of IS on organisations (Hirschheim and Klein, 1989). Further evidence of the direction of change can be seen in the suggestion by some researchers that positivist and interpretive methods can be complementary and can enrich and inform one another (Lee 1991). Based on Latour's criteria, interpretivism is well established as an acceptable form of quality research.

3.4.2 Ontological and Epistemological Assumptions in Interpretive Research

The aim of an interpretive inquiry is to gain an understanding and a reconstruction of the mental constructs that people hold and to aim towards a consensus of interpretations (Guba and Lincoln, 1994). Assuming a relativist ontology, interpretive research emphasises the importance of multiple and subjective meanings, through which humans construct their realities (Denzin and Lincoln, 1994). Organisations, groups and social systems do not exist apart from humans, and hence cannot be apprehended, characterised and measured in some objective or universal way. Unlike the premises of the positivist perspective, where researchers are presumed to discover an objective social reality, interpretive research believes that social reality can only be interpreted (Guba and Lincoln, 1994). While interpretive research shares with the positivist philosophy a belief in relatively orderly interaction, this regularity is not attributed to functional cause and effect relationships of the social system, but to shared constructions and meanings that bind individuals together (Orlikowski and Baroudi, 1991). Interpretive researchers recognise that as meanings are formed, transferred and used, they are also negotiated and hence interpretations of reality are subject to change over time, as circumstances change.

Interpretive research is premised on the subjectivist epistemological belief that the researcher creates understanding through the interaction with the subject of investigation (Denzin and Lincoln, 1994). As the researcher is assumed to be interactively linked with the subject of investigation, the values of the researcher inevitably influence the inquiry process. This posture is different from positivist research in two ways. First, it challenges

the positivist objective epistemology in the belief that the researcher and the subject of investigation are two independent entities and that the researcher is capable of studying the subject without influencing it or being influenced by it. Second, interpretive research challenges the positivist distinction between ontology and epistemology. What can be known and what constitutes reality is inextricably intertwined with the interaction between a particular researcher and a particular subject of investigation (Guba and Lincoln, 1994).

So far, the interpretive research has been treated as a coherent and unified inquiry perspective. However, the interpretive perspective is not entirely homogeneous and a "weak" and "strong" form can commonly be differentiated (Orlikowski and Baroudi, 1991; Schwandt, 1994, McLoughlin, 1999). The weak form assumes that once the process of social construction of technology has ended, technology has characteristics and capabilities which can have such effects as organisational change (McLoughlin, 1999). The weak form of interpretive research is understood to complement positivist research by filling the knowledge gaps of positivism such as investigating the inherent complexity, ambiguity and instability of organisational systems (Daft and Wiginton, 1979). The strong form of interpretive research views technical characteristics and capabilities as never fixed, but essentially undetermined and constantly open to interpretive flexibility (Woolgar and Grint, 1991). The strong form of interpretive research aims not to complement positivist investigations, but to replace them because, as it would be argued, the researcher cannot independently and objectively assess reality when technology can never have a definitive character or effect (Orlikowski and Baroudi, 1991).

This research takes a weak interpretive viewpoint, holding the belief that through processes of interpretation technology can have characteristics and capabilities (Tyre and Orlikowski, 1994). Interpretive research is seen as complementing rather than substituting positivist research.

3.4.3 Principles for Evaluating Interpretive Case Studies

While the conventions for evaluating IS case studies conducted in the positivist tradition are now widely accepted, this is not the case for interpretive case studies (Klein and Myers, 1999). One of the key contributions of the research methods stream in IS research has been the formulation of a set of methodological principles for case studies that were consistent with the conventions of positivism (Benbasat et al., 1987; Lee, 1989; Yin, 1994). The principles proposed in this stream have become standards against which most positivist case study research in IS is evaluated. (Klein and Myers, 1999). However, positivist principles are inappropriate for interpretive case study research, since they are based on different ontological and epistemological assumptions. More recently, conceptual papers on interpretive case study research sought to address this gap in the literature by suggesting some guidelines and reference points for conducting and evaluating interpretive case study research in IS (Walsham, 1995; Klein and Myers, 1999).

Klein and Myers (1999) point out that the proposition of a set of principles for conducting and evaluating interpretive case studies might violate the freedom and very nature of interpretive research. However, they also argue that while interpretive research does not subscribe to the idea that a pre-determined set of criteria can be applied in a mechanistic way, this does not mean that there are no standards at all by which interpretive research can be judged. Walsham (1995) makes the point that despite the differences of positivist and interpretive case study research, there are fundamental similarities and common conducts of research. As Walsham (1995) argues, to establish the credibility of interpretive research: "Reporting on 'soft' human issues is not an excuse for sloppiness" (p.79). Both Walsham (1995) and Klein and Myers (1999) propose a set of principles that are intended to help conduct and evaluate interpretive case study research. Table 3.1 presents a synopsis of these principles, gives a short description and illustrates how they

are applied in this research. The remainder of this section will look at these principles in more detail.

	Definition of principle	Application in this research
Role of theory in interpretive studies	Research needs to state its use of prior knowledge and show sensitivity to possible contradictions between theoretical preconceptions and actual findings.	This research uses theory/prior knowledge as: • Part of an interactive process of data collection and analysis • Final product of research
Contextualisation	Research needs to give the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.	This research provides the organisational history, culture and relationships between organisational units for each case study.
Role of the researcher	Research needs to state the role of the researcher and the relationship to the personnel of the case organisation.	The researcher adopts the role of an outside observer during data collection.
Recognition of multiple interpretations	Research needs to take account of possible differences in interpretations among the participants.	This research involves a wide range of participants who were involved and affected by the innovation process.
Suspicion	Research needs to be sensitive to possible biases and systematic distortions in the narratives collected from the participants.	This research involves participants who are at the fringes of the innovation process and therefore less under the influence of a dominant construction of reality.
Generalisation from interpretive research	Research needs to abstract and generalise from idiographic details to describe the nature of human understanding and social action.	This research abstracts and generalises from the empirical data, by suggesting a theoretical framework for understanding knowledge processes underlying IT-based innovations.

Table 3.1: Principles for Conducting and Evaluating Interpretive Case Studies (based on Walsham, 1995 and Klein and Myers, 1999)

Both Walsham (1995) and Klein and Myers (1999) suggest that researchers should state the role of theory in their work. This research uses theory as part of an iterative process of data collection and analysis, as well as a final product of the research. Existing research on the management of knowledge in IS-based innovations was used to create an initial framework to inform but not prescribe early empirical work. Through dialogical reasoning, an improved understanding of knowledge processes in IS-based innovations was achieved. Walsham (1995) compares this process with the use of scaffolding in putting up a building, where the scaffolding is removed once it has served its purpose. This research has also produced theory as a final output, by suggesting a knowledge-focused perspective on IT-based innovations.

Klein and Myers (1999) propose that the subject under investigation needs to be set in its social and historical context, so that the intended audience can see how the current situation under investigation emerged. Contextualisation helps to understand the surrounding historical, political and economic forces that affect the organisation under study. This research follows the principle of contextualisation by providing a description of the organisational context in each of the case studies, including the organisation's history, its culture and the relationships between organisational units within the bigger corporation. This social, historical and economic contextual information is important to better locate the innovation process.

Walsham (1995) and Klein and Myers (1999) make the point that interpretive researchers are not sheer data collectors, but interpreters of other people's interpretations, which are then filtered through their own conceptual apparatus. It has to be recognised that researchers inevitably influence the interpretations of those people who are being researched (Giddens, 1984). In conducting interpretive case studies, it is important that the researcher has a view of their own role in this process (Walsham, 1995). In this research, the role of an outside observer is adopted, so as to have better access to the different views and opinions organisational members have about the integration of B2B e-commerce. The advantage of this role is that the researcher was seen as not having a direct personal stake in any outcomes, and thus organisational members were often relatively frank in expressing their views. The disadvantage of being an outside observer, mainly not being present in many occasions and being inhibited from getting a direct sense of the case organisation (Walsham, 1995), was overcome, at least to some extent, by spending considerable time with employees in the case organisations.

Founded in the very nature of the interpretive tradition, research needs to take account of possible differences in interpretations among the participants, which are typically expressed in multiple narratives or stories of the same sequence of events under

investigation (Klein and Myers, 1999). The researcher's task is to seek out and document multiple viewpoints along with the reason for them. This research applies the principle of multiple interpretations by interviewing a wide range of participants, and illustrates their beliefs and interpretation of the integration of B2B e-commerce as detailed in the following section.

Klein and Myers (1999) emphasise that the researcher needs to exercise sensitivity to possible biases and systematic distortions in the narratives collected from the participants. Borrowing ideas from critical social theory, Deetz (1996) makes the point that social constructions of reality can favour certain interests, so that alternative constructions might be obscured or suppressed. Therefore, the given construction might reflect the domination of one specific group of participants. In this research, the principle of suspicion is followed by being aware of the reasons for the researcher being given access, e.g. to compile a report for the company, and by involving participants who were at the fringes of the innovation process and therefore less under the influence of a dominant construction of reality.

Walsham (1995) and Klein and Myers (1999) argue that interpretive research needs to be able to generalise from the case study in order to have explanatory value. Walsham (1995) distinguishes four types of generalisation from interpretive case studies, namely the development of concepts, the generation of theory, the drawing of specific implications, and the contribution of rich insight. The development of concepts refers to the creation of abstractions from the empirical work. The generation of theory involves the construction of theoretical frameworks that guide further studies. By drawing specific implications, causal relationships are suggested. Rich insights refer to the extensive provision of a wide range of issues and topics. The key point made is that generalisation and theory play a crucial role in interpretive research and clearly distinguish it from just anecdotes (Klein and Myers, 1999). However, in contrast to positivist research, which is interested in

verifying or falsifying theories, interpretive research uses theory as a sensitising device for viewing the world in a certain way (Klein and Myers, 1999). This research abstracts and generalises from the empirical data by suggesting a theoretical framework that may help understand how knowledge is managed in IT-based innovations and so guide future work.

Walsham (1995) and Klein and Myers (1999) make it clear that the set of principles cannot be applied mechanistically. For example, even interpretive research of high quality that was published in referred journals did not follow all of the guidelines (Klein and Myers, 1999). However, they serve the valuable function for this research of incorporating some quality criteria for the interpretive work done by this research. As argued above, this research seeks to reflect on the fundamental issues of interpretive research, not only to position it in the academic field, but also to increase its credibility.

3.4.4 Rationale for Interpretive Approach in this Research

This research adopts an interpretive approach for researching the management of knowledge during the integration of B2B e-commerce for two reasons. Knowledge, as defined by this research, is seen as an interpretation of socially constructed realities that are situated in time and context. This definition made a paradigmatic choice in so far as it adopts an interpretive ontological position. It is further acknowledged that the nature of the phenomenon under investigation has a high degree of inherent complexity and ambiguity, as knowledge is multifaceted and contested. The point has been made by a series of researchers that the positivist approach is unable to reflect the complexity and ambiguity required to investigate meaning systems (Daft and Wiginton, 1979; Benbasat et al., 1987; Orlikowski and Baroudi, 1991; Walsham, 1995). Hence, conducting the research in the interpretive paradigm appeared to be the consequent choice for this research. By adopting an interpretive research approach, the research contributes to the diversity of research in the field of IS and innovation research, which has long been dominated by the positivist tradition (Orlikowski and Baroudi, 1991).

3.5 Research Design

After having outlined the interpretive case study approach, the next step is to define the research design. In the most elementary sense, the research design determines the logical sequence that connects the empirical data to a study's initial research questions (Yin, 1994). Yin (1994) defines the research design as "*an action plan for getting from here to there*, where *here* may be defined as the initial set of questions to be answered, and *there* is some set of conclusions (answers) about these questions" (p.19, original emphasis). In other words, the research design needs to make sure that the research questions can be sufficiently answered by the way the empirical part of the research is composed. The research design covers issues such as the statement of the research question, the definition of the unit of analysis and the selection of suitable sector and case companies. Each of these issues is addressed in this section.

3.5.1 Exploratory Nature of this Research

Darke et al. (1995) argue that exploratory research is needed in the IS field where theory and research are not well developed. In the case of this research, both theory and research are at an early stage. The literature review revealed that there is no theoretical work that provides an analytical framework to understand how knowledge is managed in IT-based innovations. There is a need to explore the usefulness of potential frameworks before they are refined. The literature review also highlighted that there is a significant lack of empirical research investigating the organisational integration of B2B e-commerce. Orlikowski and Iacono (2001) point out that there is a great empirical need to explore the organisational implications of new Internet-based technology such as B2B e-commerce. Interpretive research, as Walsham (1995) argues, is well suited for conducting exploratory research.

One implication for this research is that for understanding how knowledge was managed during the integration of B2B e-commerce, multiple areas of existing research needed to be

addressed in order to understand the phenomenon as a whole. For example, there is a substantive body of literature arguing that ICT improves knowledge sharing among organisational members (Grover and Davenport, 2001). Although this research collects data about the use of ICT for knowledge sharing, it is done to understand the management of knowledge in IT-based innovations, rather than to make a contribution to the body of literature on ICT. A further implication of exploratory case study research is for the way the research question and the research propositions are formulated. Concerning the research proposition, Yin (1994) argues that exploratory case studies have a legitimate reason for not having any propositions. Moreover, it would be difficult to reconcile research propositions with the interpretive approach, as this would prematurely limit the understanding of the phenomenon.

3.5.2 Research Questions and Unit of Analysis

The specific research questions are:

- How can the nature and role of knowledge be conceptualised in IT-based innovations?

- How is knowledge being managed in IT-based innovations?

The unit of analysis identifies what constitutes a "case", and a complete collection of data for one study of the unit of analysis forms a single case (Yin, 1994; Darke et al., 1998). The unit of analysis for this research is the activity of integrating B2B e-commerce with the implementation project within a firm, as the point of entry. The implementation project is defined as an organised activity within a company that is responsible for planning and implementing B2B e-commerce. The research will be conducted within the company in which the implementation process, such as the introduction of new technology and work processes, is initiated. The range of people, who are relevant for the researcher's understanding of the implementation process, reaches from an inner circle of people who

are members of the project team to an outer circle of people who are involved in and affected by the innovation process.

Besides setting a boundary to determine the place and people involved, it is important to define the beginning and, if possible, the end of the integration activity. The beginning of the process can be defined as the point in time when organisational members become aware of B2B e-commerce and relate it to organisational activity. Defining the end of the process is more difficult, as the IT-based innovations can develop further, due to new technology or business processes being added to the initial project (Clark and Staunton, 1989). For this research, the integration of B2B e-commerce can be considered to be completed, at least for analytical purposes, when new technology and business processes are used for the intended purpose routinely and have been integrated into the organisational and technical systems, e.g. routinised (Rogers, 1995).

3.5.3 Choice of Sector and Number of Case Studies

Pettigrew (1990) suggests that the choice of sector should provide a stimulating contextual background that is likely to produce rich and significant activities in relation to the phenomenon under investigation. The main sectors benefiting from B2B transactions by integrating their supply chains through web-based applications were vehicle manufacturing, shipping, chemicals, industrial and high technology equipment (OECD, 1999a). From these sectors, the vehicle manufacturing and high technology equipment, e.g. computing and electronics, were perceived to be leading adopters of B2B e-commerce (The Economist, 1999; OECD, 1999a). The vehicle manufacturing sector was selected for two main reasons. First, the majority of organisations in the vehicle manufacturing sector tend to be traditional and functionally organised (Whipp and Clark, 1986). In contrast, B2B e-commerce involved the integration of organisational business processes across internal organisational boundaries (US Department of Commerce, 2000). In terms of knowledge, the requirement of internal integration presents a particular challenge to the

unification of different bodies of knowledge held in an organisation. Second, due to the economic slowdown, the vehicle manufacturing sector was under pressure to implement cost savings. B2B e-commerce was promoted as a major means to reduce costs. In terms of knowledge, there was likely to be a great organisational demand for B2B e-commerce, and subsequently a number of implementation projects.

Both single and multiple case design can be adopted for exploratory research (Darke et al., 1998). While single cases provide in-depth investigation and rich insights into organisational processes, a multiple case design allows one to draw theoretical conclusions from cross-case comparison (Yin, 1994; Darke et al., 1998). This research adopts a multiple case study approach by conducting empirical research in two case companies. However, the multiple case design is not seen to establish the basis of a comparative analysis, but to have two separate empirical cases in which a variety of issues under investigation can be found. The advantage of conducting research in two case companies is to investigate phenomena in depth to provide rich description and understanding of the implementation of IS in organisations (Orlikowski, 1993; Walsham and Waema, 1994; Myers, 1994b) and, at the same time, have variance in implementation issues and topics.

3.5.4 Choice of Research Sites and Access

In terms of the size of the organisations chosen for research, it is frequently being argued that e-commerce will bring great benefits for small and medium-sized enterprises (SMEs) (OECD, 1999b). However, it was decided to focus on large organisations in the vehicle manufacturing sector for three reasons. First, large organisations tend to have the necessary resources to initiate the integration of B2B e-commerce, whereas the IT investments of SMEs tend to be considerably less. Second, Internet usage for business purposes is substantially higher among large organisations than SMEs (OECD, 1999a). Third, large organisations appear to yield more interesting findings, as the integration of B2B e-commerce is likely to be on a bigger scale and involve a larger number of people.

Pettigrew (1990) advocates the selection of polar types of organisations, in order to identify deviating patterns of the phenomenon under investigation. Two indicators were selected to establish polarity in the selection of the two companies in the vehicle manufacturing sector. One indicator was company performance measured by total output and financial success. Company performance as an indicator would give an approximate idea about the resources available and the need for the integration of B2B e-commerce. The other indicator was the type of product the organisation would produce. Using the product as a differentiating criterion, two major groups of organisations in the vehicle manufacturing sector can be identified. The first group consists of organisations that are involved in the production of personal cars. The second group consists of organisations that are involved in the production of commercial vehicles such as lorries, excavators, tractors etc. In terms of sectoral patterns of technical change, personal car producers tended to be leading in the adoption of innovations, while commercial vehicle producers appeared to be much slower in adopting new innovations (Pavitt, 1994).

Based on both indicators, two companies were selected. First, ComCo, a producer of commercial vehicles mainly for the agricultural sector, was selected. At the time of the research design, ComCo was faced with a decline in output and trading was considered to be difficult for the company. Second, AutoCo, a producer of luxury cars, was selected. At the time of the research design, AutoCo was expanding production and expanding its market share.

At the same time, both companies shared a great deal of similarities, which would minimise extraneous variations and clarify the domain of the findings as large organisations operating in specific types of environments (Eisenhardt, 1989). The similarities were:

- **Both companies are original equipment manufacturers (OEMs).** ComCo and AutoCo are both manufacturers of automotive products. This means that they have the same position in the value chain as a focal point of producing the end product. In addition, similar sorts of relations to suppliers, dealers and end customers exist.

- **Both companies are leading producers in their field.** ComCo and AutoCo belong to the world leaders with their products, in terms of market share and technical sophistication of the product. ComCo has been the world's leading producer of high-end tractors since the 1960s in terms of market share. AutoCo is among the world's leading producers of luxury cars.

- **Both companies are UK-based.** ComCo and AutoCo are both based in the UK. Both companies share common experiences such as world economic developments (e.g. world wars, recession, expansion etc.) and periods of industrial unrest that have occurred in the UK. In addition, the organisations have the same national cultural background.

- **Both companies have a long independent history.** ComCo and AutoCo have a long independent company history that can be traced back to the end of the 19th century. Having a long independent history, both companies developed a clear self-perception of being an entity rather than an extension or branch of another company.

- **Both companies are functionally organised.** ComCo and AutoCo are both functionally organised.

- **Both companies belong to an US multi-brand corporation.** ComCo and AutoCo lost their independence at the beginning of the 1990s when they were acquired by US corporations. The reason for the acquisition was that both companies had serious problems with their business performance. In addition, ComCo and AutoCo are part of multi-brand corporations. WorldCo, the owner of ComCo, owns a number of companies

that produces equipment for the agricultural sector. CarCo, the owner of AutoCo, owns a number of other car producers.

Due to the choice of research sites, the findings are certain to reflect the experience of a specific type of organisation. First, both companies are large organisations, which are part of a global multi-brand corporation. Therefore, the experience of implementing B2B e-commerce is likely to be significantly different from those by SMEs, which tend to operate on a national level and have fewer resources available for IT-based innovations. Second, both companies are OEMs in the vehicle manufacturing sector. Hence, the experience may well be different from IT-based innovations in the service sector due to different business processes, and from other manufacturing companies which do not occupy a central place in the supply chain. Third, both companies are functionally organised which requires different organisational groups to overcome internal organisational boundaries in order to create, share and retain knowledge. Therefore, the experience of managing knowledge is likely to be specific to functional organisations rather than other, more integrated organisational forms such as service organisations e.g. consultancies.

The initial contact with ComCo was facilitated through a contact at the Warwick Manufacturing Centre who was aware that ComCo intended to start an e-commerce initiative. A cold call approach was adopted to identify the key person, Robert Miles, responsible for the e-commerce initiative. He was initially very sceptical of involving a researcher as ComCo had no prior experience of working with academia. Still, the researcher was able to arrange a meeting with Robert Miles in March 1999 to explain the nature of the research and potential benefits of involving the researcher, such as providing feedback and identifying lessons learned in the vehicle manufacturing sector. After consulting his managers, Robert Miles, who became the principal contact, granted access. He took on the role of arranging interviews to "break the initial ice" as employees could "neither make head nor tail" of being interviewed due to the non-existence of academic

research in the organisations before. As the research required the researcher's participation in meetings and access to confidential documentation, a confidentiality agreement was signed. The confidentiality agreement prohibited making any information public without the prior agreement of ComCo, except for the purpose of writing the thesis.

Gaining access to AutoCo was facilitated by the fact that the responsible person for one B2B e-commerce project was doing a part-time Masters by Research degree at Warwick Business School. Initial contact was made by telephone and followed up with a meeting in March 2001. Having already researched into the industry and conducted interviews within ComCo, the cold call approach could be smoothed by demonstrating a familiarity with sector issues and experience in issues relevant to implementing B2B e-commerce. A further meeting was organised with the manager responsible for the B2B e-commerce initiative at AutoCo and access was granted. AutoCo had previous experience of having researchers on site and organisational members tended to be familiar with having an outsider around. In exchange for being given access, the researcher was asked to help compile a report on one B2B e-commerce application. As with ComCo, a confidentiality agreement was signed, as the researcher obtained full access to documentation and was involved in meetings, during which sensitive business issues were discussed.

3.6 Data Collection

Evidence for case studies may come from six sources: documents, archival records, interviews, direct observation, participant observation, and physical artefacts (Yin, 1994, Stake, 1994; Remenyi et al., 1998). The research involved three main types of data, namely in-depth interviews, observations and documentary data. Table 3.2 provides details regarding the sources of evidence for both case studies. The data collection regarding these three sources is outlined in this section.

Interviews	ComCo	AutoCo
Number of interviews	20	26
Length of interviews	1-2 hours	1-2 hours
Total hours of interviews	30 hours	31 hours
Observations		
Meetings attended	6 (strategy workshops)	4 (review meetings)
Site visits (non-participant observation)	14 (incl. MIS, purchasing, marketing departments)	10 (incl. purchasing department, reverse auctions, CIPS event)
Documentation		
Access to project documentation	Open	Open

Table 3.2: Sources of Evidence

3.6.1 Interviews

Interviews are the primary data source when conducting interpretive case studies as an outside observer (Walsham, 1995). Through interviews, the researcher can best access the interpretations that participants have regarding the actions and events that were taken place and the views and aspirations of themselves and other participants (Walsham, 1995). In order to conform with Klein and Myers' (1999) principles of multiple interpretation and suspicion, it is necessary to interview a sufficiently large number of people, to ensure that an accurate and representative picture can be built up. Within the case company, stakeholders included members of the B2B e-commerce initiative, users and supporting senior management. Outside the case company, stakeholders included consultants, suppliers and organisational members in other organisations within the corporation, such as top management and members of other B2B e-commerce initiatives.

Based on the preliminary discussion during the access negotiation at ComCo, an initial list of approximately 25 interviews was drawn up in April 1999, including interviews with project members, users, senior management at ComCo, top management at WorldCo, consultants and suppliers. At that time the integration of B2B e-commerce was in an initial phase in which the strategy for the initiative was being developed. As there were at that time no users, suppliers or top management at WorldCo involved, interviews were

arranged with organisational members involved in the B2B e-commerce initiative. Even after consistent effort, senior management at ComCo and consultants were reluctant to be interviewed. The researcher sought to compensate this with frequent conversations during workshops and general meetings. For example, the researcher took part in a one-day executive workshop in which all senior managers were involved. Besides taking extensive notes during the formal part of the workshop, the researcher approached individuals during the coffee and lunch breaks to ask questions. As it was inappropriate to take out a tape recorder or a note pad, notes were taken immediately after the conversation in an empty room or in the toilets. To compensate the lack of interviews with consultants, the researcher frequently jointed the consultants in coffee breaks and was invited to a barbecue arranged by the main consultant.

One major problem occurred when ComCo's B2B e-commerce strategy was rejected and the planned B2B e-commerce projects had to be scaled down due to the lack of financial resources. The major effect on the interview arrangements was that there were only a limited number of people actually involved in and affected by B2B e-commerce. Consequently, the principle contact was unable to arrange interviews with users, suppliers and dealers, as they felt that "there is nothing to talk about". The researcher sought to compensate this with informal conversations with very limited success. A cold call approach was adopted to arrange interviews with about ten of ComCo's suppliers and dealers. The common replies were " we don't have time for this stuff", "we are too small", or "we don't know anything about e-commerce". Conversations with users at ComCo were equally fruitless. Common replies were "e-commerce hasn't taken off yet" and "nothing has really changed". In order to get at least some insights from suppliers, dealers and users, the researcher conducted interviews with competitors of ComCo. Between April 1999 and November 2001, a total of 20 interviews were conducted. A list of interviewees and their role in the integration of B2B e-commerce is included in appendix A.

In comparison to ComCo, there were no problems with the arrangement of interviews at AutoCo. After being granted access by the purchasing manager, the researcher was given complete freedom to select interviewees, including members of the B2B e-commerce initiative and users. Twelve interviews were set up by an internal email from the principle contact that introduced the researcher and explained the purpose of the study. All twelve employees agreed to be interviewed. In addition, further interviews were set up by the researcher and conducted with consultants, organisational members of B2B e-commerce initiatives in sister organisations, and suppliers. The researcher also interviewed organisational members of AutoCo's competitors to gain insights into their experience with B2B e-commerce. In contrast to ComCo, it was possible to interview a wider range of people and a total of 26 interviews were conducted between April and October 2001. A list of interviewees and their role in the integration of B2B e-commerce is included in appendix B. On the whole, arranging interviews was straightforward and easy compared to the ComCo case.

The interviews were semi-structured. The advantage of this approach is that it provides interviewee with the latitude.to supply information that is not necessarily anticipated by the interviewer, hence potentially enriching an interpretive analysis (Walsham, 1995). For the semi-structured interviews, an interview template was constructed, which is contained in appendix C. The purpose of the interview template was to guide respondents through a series of questions grouped around specific themes, particularly about project details, knowledge processes, and personal evaluation of the integration of B2B e-commerce. The questions around the project details helped establish the narrative about the integration of B2B e-commerce. The questions related to knowledge processes were targeted to gain a better analytical understanding of how knowledge was managed during the innovation processes. The personal evaluation gave the interviewee the opportunity to reflect on the innovation process and highlight problems such as political conflict.

Although the interview template might suggest a linearity of questions, in practice, each interview was unique in that interviewees addressed issues in different orders and emphasised different issues. The interview template was useful for the researcher in that it highlighted areas of interest rather than being a "fixed to-do list". The challenge for the researcher was to ask questions related to areas of interest when it was most appropriate during the interview, without interrupting the flow of the conversation. Consequently, similar questions could be asked at different stages during different interviews. Also, questions needed to be adjusted to reflect the background of the interviewees and the context of the interview.

In the preparation for the interviews, the researcher familiarised himself with the topic of B2B e-commerce by reading newspapers, e.g. The Financial Times, journals, e.g. The Economist, consultancy publications, e.g. from A.T. Kearney and IBM Consulting, and visiting manufacturing-related websites, e.g. www.just-auto.com. A thorough awareness of the subject matter helped both to build the necessary degree of seriousness and rapport with the interviewees and to better understand any topics discussed by the interviewees. Before each interview, the researcher introduced himself, briefly outlined the purpose of the research and assured the confidentiality of the interview. During the interviews, the researcher assumed a subordinate role as learner and the person interviewed predefined as "clearly in the know" (Agar, 1980). Interviews tended to last between about one hour and two hours. The researcher avoided interrupting during the main part of the interview, except to clarify or to refocus the discussion where it was felt that an interviewee was drifting too far from the research focus. Some interviewees were clearly more revealing than others, as some found it difficult to articulate their thoughts with regards to knowledge-related issues such as the use of expertise and sharing knowledge. While most interviews were face-to-face, five interviews with interviewees abroad were conducted by telephone.

In order to reflect the researcher's understanding of the integration of B2B e-commerce, the researcher fed back his understanding of what interviewees had said and asked them to comment. Statements or perspectives from certain interviewees were also put to other interviewees, to obtain their reaction. Where they disagreed, this was explored with the interviewee and, if necessary, revisited with the original source. During the interview, provocative propositions were put to interviewees in order to seek their response. An example of such a statement is "A view held by a number of people I have interviewed is that your department doesn't share any information or expertise with users. Do you agree?". By this method, the researcher tried to establish a shared understanding of a particular participant's narrative.

The first nine interviews at ComCo were tape-recorded. However, although the researcher stressed the confidentiality of the tape-recorded interview, interviewees were clearly uncomfortable and only tended to speak uninhibited once the tape-recorder was switched off. In most cases, the interviewees talked on for approximately one additional hour addressing mainly sensitive and political issues. Whereas the content of the tape recorded interview tended to provide "factual data", giving a chronological account of the innovation process, the real analytical value came from the non-tape recorded part of the interview. Because it was clearly inappropriate to take extensive notes after the tape recorder was switched off, there was a risk of loosing this valuable part of the interview. Consequently, notes were taken for the remaining 11 interviews. Tape-recording at AutoCo was categorically refused from the start. The reason for this was an earlier incident when another researcher covertly tape-recorded a meeting in the purchasing department without prior consent. This incident was part of the organisational narrative about the organisation's experience with academic research which made it impossible to convince interviewees otherwise.

Although tape-recording was the preferred reporting media by the researcher, problems associated with note taking were thought to be overcome for a number of reasons. First, as the first 9 interviews were tape-recorded, the researcher gained confidence in interviewing people so that note-taking did not distract from conducting an interview. Second, in order to improve the quality of note-taking, interviews needed to be better prepared by studying earlier interviews and other sources of evidence in order to be fully aware of organisational issues. Third, interview notes were transcribed into an interview document immediately after the interview, when the interview was still fresh in the memory. The researcher's experience was that the compilation of the interview documents took the same time as the transcription of tape-recorded interviews.

3.6.2 Observational Procedures

The aim of the observational procedures was to obtain a "feel for the organisation" by observing directly the locations, individual behaviour, behaviour at meetings and corporate culture. It also offered an opportunity to talk to people informally and ask questions outside interviews. The research used two approaches to collect observational evidence. First, the researcher attended meetings in both case study companies. It was ensured that any documentation was available to the researcher. The researcher took extensive notes throughout these meetings with regards to implementation issues discussed, knowledge-related processes, power relations, evidence of informality e.g. jokes. Second, the researcher spent time on the case study premises, to observe the interaction between employees and follow the pattern of day-to-day work. There was also the opportunity to see the interviewee's workplace and some of the B2B e-commerce applications in action. As with the meetings, notes were taken to capture the researcher's perceptions. In both companies, it was possible to establish good relations with organisational members.

When attending meetings at ComCo, the researcher was introduced to the attendees by the principle contact, who reinforced the issues of confidentiality and encouraged the attendees

to ignore the researcher's presence. The researcher adopted a "fly on the wall" position and did not actively engage in the discussion. Although it is difficult to assess the impact of the researcher's presence at any meetings, it is assumed that it did not alter the interaction of attendees, as sensitive and confidential issues were discussed and some strong arguments were fought. The researcher attended all the e-commerce workshops in 1999, in which representatives of all functions were present, and a number of additional project meetings. This gave a particularly good picture of the interaction between different functions and the relationship between ComCo and WorldCo. In terms of observations during site visits, considerable time was spent talking to employees informally. Such informal conversations with senior management and consultants provided an opportunity to at least partly compensate for the lack of interviews with them.

The researcher's "feel for the organisation" changed significantly after the rejection of ComCo's e-commerce budget for 2000. During the strategy development in 1999, there was "an air of excitement", as one organisational member involved in the e-commerce initiative put it. The researcher had the impression that senior management at ComCo, the members of the e-commerce initiative and heads of different functions saw B2B e-commerce as a genuine new way, not only to improve business processes with external partners, but also to work together more closely internally. Organisational members were enthusiastic and had positive expectations. However, after the rejection the whole atmosphere surrounding the B2B e-commerce initiative changed and organisational members' personal commitment had gone. Instead, B2B e-commerce "became like any other IT project" where organisational members do their work as part of their job. Whereas prior to the budget rejection, wide parts of ComCo seemed to be infused by the idea of e-commerce, after the budget rejection only a small circle of managers tried to maintain the momentum and kept the initiative going. For the researcher, one of the

amazing insights was the resilience and persistence of these managers when other parts of the organisation had lost interest in B2B e-commerce.

At AutoCo, the researcher participated in a number of conference calls and meetings. Additionally, time was spent in AutoCo's purchasing department to talk informally to users. This was facilitated by the fact that the purchasing department was an open plan office and it was very easy to move around and talk to people. In one occasion, the researcher spent the whole day in the purchasing department helping to repair a corrupted parts drawing that needed to be sent to suppliers in preparation for a reverse auction. This was a very good opportunity to observe buyers' day-to-day working routine and the dynamic in the purchasing department. The researcher also observed a number of successful and unsuccessful reverse auctions, which helped understand the interaction between buyer, external consultant and B2B e-commerce project team members.

The researcher felt that the atmosphere at AutoCo was generally far more positive than at ComCo. While at ComCo projects in general tended to be conducted on a "piecemeal basis" due to the general problem of getting funding, projects at AutoCo tended to be conducted on a greater scale, with money and human resources readily available. The metaphor of a "poor and rich cousin" might be used to describe the difference between ComCo and AutoCo. Although both companies had very skilful people, organisational members at AutoCo appeared to be more confident in seeing projects through and prouder of their previous achievements. At AutoCo there was a greater emphasis on formality reflected, for example, in the importance of organisational and reporting structure. The researcher also had the impression that organisational members tended to take greater pride in working for AutoCo, which symbolise luxury and sophistication, than for ComCo, which is commonly associated with farming.

3.6.3 Documentation

In addition to interviews and observations, documentation was used as a source of evidence. Documents were primarily used to corroborate and augment from other sources and gave a valuable context for interviews or discussions within the case study organisations. For this research, any documentation related to the integration of B2B e-commerce was of particular value.

At ComCo, the researcher was given free access to all project documentation and any documents that were handed out during meetings. The documentation for the strategy development amounted to about 300 A4 pages. The only documents withheld were the final budget proposals for the e-commerce initiative at ComCo that were presented to top management at WorldCo. This was considered to be extremely sensitive, as it included strategic financial data beyond the e-commerce initiative. It has to be pointed out that the level of documentation decreased dramatically after the rejection of the e-commerce budget, which basically culminated in two A4 sheets showing graphically the relationship of the different e-commerce projects. The researcher was able to obtain a copy of this.

The researcher was also provided with free access to project documentation at AutoCo. However, project documentation was very limited throughout the implementation process. The main documents were an A4 sheet depicting the business process to set up a reverse auction for buyers, a six page summary of all reverse auctions held in 2001 and an eight page plan for auctions to be held in 2002. The researcher also had access to CarCo's intranet, from which a number of print outs were taken that were important to the understanding of US CarCo's version of the purpose of reverse auctions. In addition, project documentation was obtained about the eVEREST initiative, which was the overarching B2B e-commerce strategy in the CarCo corporation. This was helpful for putting the B2B e-commerce projects into context. The only document that was not obtainable was CarCo's strategic e-commerce document presented by the different brands

to Jac Nasser, the CEO of CarCo. The document included highly confidential information that was considered to be too sensitive because of financial data. However, in an interview with one manager at AutoCo, the researcher had a chance to browse through it and the interviewee elaborated on selected parts of it.

3.7 Analysis

Although a clear distinction between data gathering and data analysis is commonly made, this distinction is problematic for qualitative research (Myers, 2002). Particularly in interpretive research, where meaning is actively constructed during data collection, the analysis is affected in significant ways. Although the literature on qualitative data analysis has advanced greatly since the 1980s (Miles and Huberman, 1994), commonly agreed tools for the analysis of qualitative data in the field of interpretive IS research remain scarce. In order to help analyse the data for this research systematically and effectively, this research draws broadly on the operational framework suggested by Miles and Huberman (1994).

Miles and Huberman (1994) define data analysis as consisting of three interlinked and overlapping subprocesses, namely data reduction, data display and conclusion drawing/verification. These subprocesses occur before, during and after data collection. The remainder of this section details these subprocesses and illustrates the data analysis for this research.

3.7.1 Data Reduction

Data reduction refers to the process of reducing the universe of data to the content of the final report of the case study (Miles and Huberman, 1994). Data reduction is a form of analysis that sorts, focuses, discards and organises data in such a way that final conclusions can be drawn and justified. Data reduction occurs continuously throughout the life of any qualitative research project and two main stages can be identified (Miles and Huberman, 1994). In the first stage, anticipatory data reduction occurs, as the researcher decides on the research question, epistemological position, conceptual framework and data collection

approaches. As actual data collection commences, the second stage of data reduction encompasses further condensation of data through, for example, data summaries, finding themes, clustering. The data reduction process continues after the fieldwork until a final report is completed.

With regards to this research, the anticipatory data reduction started after the specification of the research questions. The first analytical choice was made when focusing on implementation and knowledge activities from a processual perspective, rather than embarking on implementation factor research or studies that treat knowledge as an object. Thus, data reduction occurred as the literature review focused on those types of academic work that were found to fit into the analytical framework underlying this research. The second analytical choice was made by choosing an interpretive case study approach rather than, for example, by conducting a survey or using a positivist case study methodology. Data reduction was achieved by concentrating on an interpretive case study method and the selection of two companies operating in the same manufacturing sector.

Further data reduction occurred during and after the data collection. During data collection, brief summaries were written to encapsulate both the B2B e-commerce integration activities and to identify all those activities related to knowledge processes. These issues could then be followed up and clarified during the remaining interview schedule. After data collection, the volume of interview data was reduced by colour-coding passages in interview transcripts and interview notes that dealt with similar topic areas. This way, redundant information could be cut out that was not related to the integration of B2B e-commerce, such as small talk and private issues.

3.7.2 Data Display

Data display can be defined as an organised, compressed assembly of information that permits conclusion drawing (Miles and Huberman, 1994). Data display is part of data analysis, as decisions have to be made as to which data is presented and how, that have, in

turn, implications for data reduction. The most frequent form of display for qualitative data is extended text. However, as humans are not very powerful as processors of large amounts of information, there is a risk of simplifying understanding and of jumping to unfounded conclusions. Miles and Huberman (1994) suggest that a graphical display, e.g. in the form of tables and figures, makes information more accessible for drawing conclusions.

Data displays were used extensively throughout this research. Throughout the data collection period, hand-drawn figures and graphs were produced that helped to visualise the integration of B2B e-commerce and relevant issues related to knowledge for the researcher. Data display continued after the data collection period both in text and graphical format. Text display took the form of transcriptions, interview notes and memos. Through data reduction, this data was organised and condensed to form the content of the case study chapters. In addition, data was displayed in graphical form to provide overviews of textual arguments and organise data in a more compact form. The key graphical displays were included in the case study chapters as figures and tables.

3.7.3 Conclusion Drawing

Conclusion drawing refers to the process by which the researcher draws meaning from the displayed data. Miles and Huberman (1994) argue that there are two different levels of understanding. The first level is descriptive and seeks to understand what is going on and how things developed, thus providing a reasonable account of the phenomenon observed. With regard to this research, each case study description provides an introduction to the organisational context and a chronological description of the integration of B2B e-commerce. The second level is explanatory and seeks to understand why things happened, by giving reasons and making statements about tendencies of processes (Miles and Huberman, 1994). Explanation has also been described as a concatenated description that puts activities or outcomes in relation to others, therefore making a description intelligible (Kaplan, 1964).

Different sets of analytical techniques or modes have been proposed to move from a descriptive to an explanatory level (Yin, 1994; Miles and Huberman, 1994). Butler (1998) and Myers (2002) argue that hermeneutics is particularly appropriate for interpretive research in the IS field, which has been applied as a mode of analysis in this research. Hermeneutics can be treated as both an underlying philosophy and a specific mode of analysis (Bleicher, 1980). As a mode of analysis, hermeneutics is primarily concerned with the meaning of textual data (oral or written text) or text-analogues (e.g. an organisation) (Myers, 2002). The analytical principle, also referred to as the hermeneutic circle, suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form (Gadamer, 1976).

> *Thus the movement of understanding is constantly from the whole to the part and back to the whole. Our task is to extend in concentric circles the unity of the understood meaning. The harmony of all the details with the whole is the criterion of correct understanding. The failure to achieve this harmony means that understanding has failed* (Gadamer, 1976, p.117).

In this context, the terms "parts" and "whole" should be given a broad and liberal interpretation (Klein and Myers, 1999). For this research, the parts refer to the researcher's and the interviewees' preliminary understanding of the activities involved in the innovation process. The whole consists of the shared meanings that emerge from the interaction between them. The complex whole of shared meanings emerges in a number of iterations of the hermeneutic circle.

If hermeneutic analysis is used in an IS study, the object of the interpretive effort becomes one of attempting to make sense of the organisation as a text-analogue (Myers, 2002). In an organisation, people can have different and contradictory views on many issues. The aim of the hermeneutic analysis becomes one of trying to make sense of the whole, and the relationship between people, the organisation and IT (Myers, 2002). More generally, hermeneutics can be seen as a fundamental principle of interpretive field research on which

various principles for conducting empirical research, such as contextualism and multiple interpretations, can be based (Klein and Myers, 1999).

An example of the application of the hermeneutic circle in this research is the analysis of knowledge sharing in the interorganisational project team at AutoCo. Team members from AutoCo, Brand I, CarCo UK and Brand II were interviewed and each gave a different account of the extent of knowledge sharing within the interorganisational project team, ranging from "it never happened" (AutoCo) to "there is a very constructive exchange of knowledge between team members" (CarCo UK). In order to better understand the contradicting parts, it was necessary to take a look at the whole. The whole included the type of relationship between the different organisations, which was strongly influenced by the political context. CarCo UK was perceived by all other organisations as interfering in their independent conduct of business, and team members of the other organisations shared the opinion that they kept the "communication to a bare minimum" between themselves and CarCo UK. In contrast, team members from CarCo UK perceived the degree of knowledge sharing as sufficient, indicating that they were either unaware or deliberately ignorant of the potential scope for knowledge sharing. In this respect, the inter-organisational implementation team was a microcosmos, which reflected the constellation and attitudes of the organisations involved. In this way, by looking at the whole, the previously contradicting parts could be understood in a meaningful and coherent way.

3.8 Summary – Reflections on the Process

The process of gathering and extracting insight from rich evidence was far from being as linear and planned as it might have appeared in the description of this research methodology. In fact, the empirical investigation was full of surprises and new revelations, which forced the researcher to backtrack on his ideas and review evidence already gathered in a new light on a regular basis. Particularly in the early stages of the case study research, the empirical data was at times overwhelming, as it was not clear how smaller "puzzles"

would fit into the bigger picture. Organisational members in both case study companies were helpful in bearing with the researcher, sometimes answering the same questions at different stages during the research.

Although the researcher expected to find different expectations and assumptions about B2B e-commerce in both case companies, it was nevertheless surprising for the researcher to see such different interpretations co-existing in the same organisation. It was a strong learning experience for the researcher to be able to move as an outside observer between these areas of meaning and how they relate to each other. It needs to be emphasised that each of the different interpretations were in themselves justifiable and perfectly legitimate perspectives on the same phenomenon. It was impossible for the researcher to use the criteria of right or wrong to evaluate different interpretations. In order to encourage organisational members to share their interpretations, it was clearly helpful to build a relationship with them by, for example, visiting various parts of the organisation and emphasising that the researcher had no alliances to particular stakeholders.

Klein and Myers (1999) point out that the researcher's subjectivity inevitably influences his or her interpretations of the phenomenon under investigation. This researcher sought to apply techniques to avoid bias and preconception, such as getting feedback from organisational members on his interpretations of events and people's perceptions. However, interpretive research always presents, at least to some degree, the subconscious worldview and personality-dependent interpretation of the researcher. For example, despite living in the UK for over six years, the researcher's German cultural background might have made him unaware of subtle nuances in meaning in how interviewees phrase ideas and thoughts. It can therefore be said that bias and preconceptions are inevitable factors that influence the researcher's work at least to some degree.

4. ComCo Case Study

4.1 Introduction

This chapter presents a chronological description and a thematic account of the integration of a number of B2B e-commerce applications at ComCo. Figure 4.1 depicts the structure of this chapter. After this introduction, the context of knowledge in IT-based innovation is set out by introducing the organisational context of ComCo and providing a chronological description of the integration of B2B e-commerce. Then, a thematic account of the innovation is given. First the processes of knowledge creation, sharing, and retention are summarised and the findings regarding the framework are outlined. This is followed by a description of issues regarding the manageability of knowledge during the integration of B2B e-commerce. This chapter concludes with a summary of the main issues found.

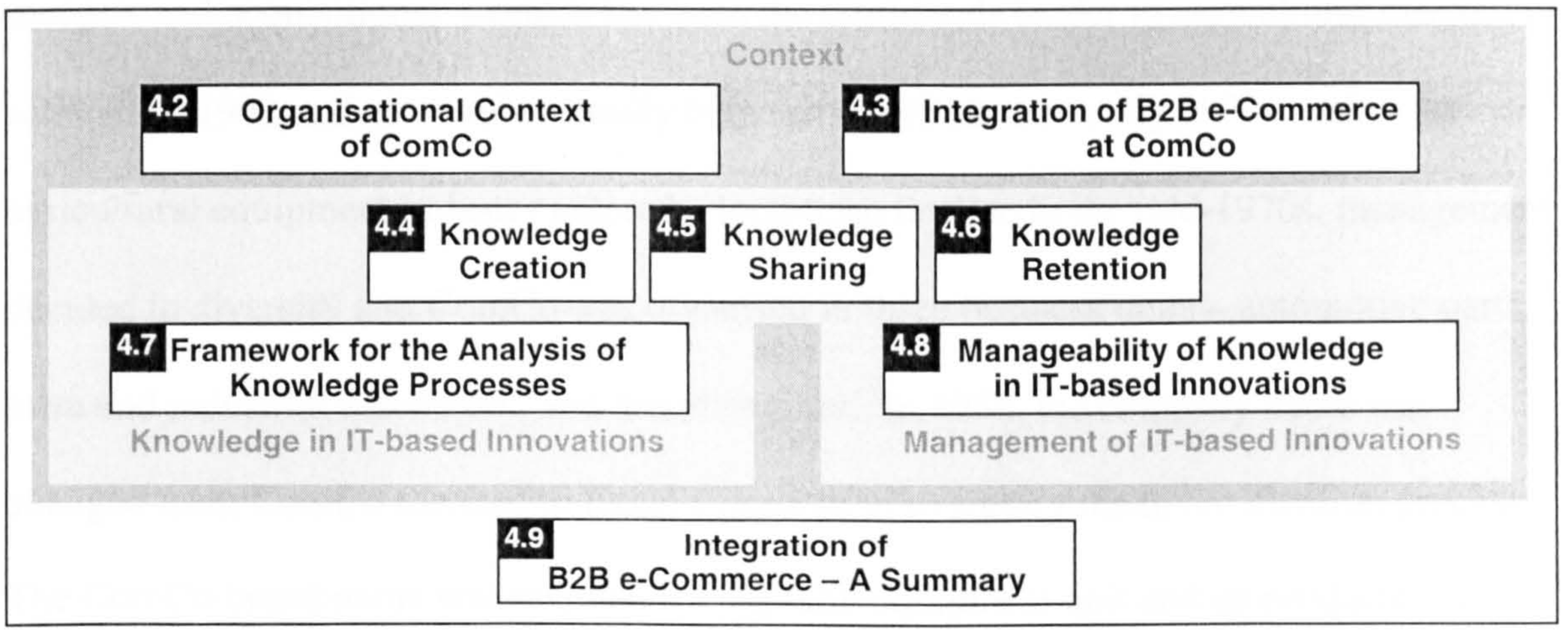


Figure 4.1: Structure of the ComCo Case Study Chapter

4.2 Organisational Context of ComCo

In order to understand many of the underlying issues during the integration of B2B e-commerce, it is important to illustrate the organisational context. This is done by presenting a brief history of ComCo, describing its relationship with its owner WorldCo, and elaborating on its values and culture.

4.2.1 History of ComCo

ComCo is one of the largest manufacturers and distributors of agricultural machinery in the world, which is sold through a network of 7,500 independent dealers in 140 countries worldwide. ComCo products are produced in company plants in the UK and France and by associate and licensee operations in eighteen countries. The UK plant is the world's largest facility devoted solely to the production of tractors with a current capacity to make 25,000 agricultural machinery a year; more than 3 million have been manufactured since 1946. The UK also functions as the headquarters for the ComCo operations in Europe, Africa and the Middle East (EAME). In 1999, ComCo in the UK employed 1,800 people who produced about 14,000 agricultural machinery. Over 90 per cent of the UK production is exported globally each year.

The ComCo company was formed over the course of 150 years and involved a number of mergers and acquisitions. ComCo has been the worldwide leader in agricultural machinery sales since 1962 and grew substantially between the 1960s and early 1970s. After the agricultural equipment industry entered a long-term decline in the mid-1970s, management decided to diversify and ComCo was organised in three business units – automotive parts, farm and industrial machinery, and diesel engines. In 1986, the company name was changed from ComCo Limited to Excel Corporation to signify the diversification process. The ComCo brand name was retained for the farm equipment unit and its products. As ComCo continued to make operating losses, Excel sold ComCo for US$330 million in cash and stock to WorldCo. Since 1998, a further slump in the agricultural sector and a strong pound crippled UK production resulting in redundancies of about 20 per cent of the work force in 2000. In May 2000, WorldCo even threatened in a Financial Times article that the UK plant would face closure if the pound remained at high levels.

4.2.2 WorldCo and its Relationship with ComCo

WorldCo is the world third biggest manufacturer and distributor of agricultural equipment with headquarters in the US. In 2000, WorldCo had sales of $2.3 billion and net income, excluding restructuring expenses, of $16.6 million, or $0.28 per share. The company sells a full range of agricultural equipment and related replacement parts, including tractors, combines, hay tools, sprayers, forage equipment and implements, which are distributed through a combination of over 8,200 independent dealers and distributors, associates and licensees. Since its formation in June 1990 by an investment group, WorldCo has grown substantially through a series of 17 acquisitions. WorldCo's share price continuously rose from US$14.50 at its initial public offering in 1992 to up to US$60 in 1997. Its strategy was described thus:

> *"WorldCo's success story, if improbable, is also deceptively simple: buy up discarded companies cheaply, squeeze out the accumulated fat, and sell multiple brands through multiple outlets. Presto! Sustainable double-digit earnings growth in a slow-growth industry."* (Quickel, 1994, p.56).

Whilst WorldCo was heralded as one of the highest growth stocks in the mid-1990s due to a strong turnover and profit growth through acquisition, 1998 was a significant turning point for the company, when the farm equipment sector slipped into recession and investors lost confidence. The share price went from about US$30 at the beginning of 1998 to about US$7 at the end of the same year. WorldCo, like other farm equipment companies, drastically reduced operations by cutting production, closing plants and cutting jobs. During the time of the research, the farm equipment industry was still in a depressed stage and WorldCo was posting losses. Due to poor business performance, there was hardly any funding available for capital intensive projects.

Throughout the interviews and during the participant observations at the meetings, it became obvious that people at ComCo were implicitly hostile towards WorldCo. Across

all the remarks made regarding this relationship between WorldCo and ComCo, there were a number of recurring issues emerging:

- **Them and us culture:** There was a clear cultural separation between ComCo and WorldCo. People at ComCo identified themselves clearly with the ComCo brand that represented a leading producer and distributor of high-quality farm equipment. People still held the notion that ComCo was an independent company. ComCo company life took place in the UK with buildings from different periods ranging from a post-war red brick administration building to a stylish 1980s tower block indicating a sense of continuity and tradition. As one senior business manager put it "we are proud of our heritage and that we produce one of the best tractors in the world". WorldCo was perceived to be too remote to play an active role in day-to-day activities at ComCo. WorldCo was frequently referred to as "the Americans" who were attempted to "interfere with our [ComCo's] business" (director).

- **Management focus on acquisition:** Interviewees remarked that WorldCo's managerial energy and attention was only focused on acquiring new companies in order to grow business. However, WorldCo management was perceived to be particularly weak in improving and coordinating the existing companies in their brand portfolio as "WorldCo might be good at buying companies but they don't have a clue how to manage them" (manufacturing manager).

- **Fixation on performance measures:** Interviewees mentioned that WorldCo management decisions were "totally obsessed" (sales manager) with performance measures and the fact that it was listed as a public company. Such performance measures included balance sheets, shareholder value, share price and growth through acquisition.

- **No understanding of manufacturing business:** Interviewees remarked that WorldCo top management did not have an understanding of manufacturing business. This was explained by the historical fact that WorldCo was predominately a distribution company before it bought ComCo. In addition, WorldCo was a fairly young company with poorly developed management processes.

4.2.3 Culture at ComCo

As indicated in the relationship between WorldCo and ComCo, there was a strong ComCo centric culture. ComCo had a long and successful history as an independent company. Particularly the engineering and production departments took great pride in creating one of the most technically advanced tractors worldwide. Although ComCo went through ups and downs in its history, there was a strong loyalty to the company. Furthermore, even after ComCo was taken over by WorldCo, the UK remained the headquarters for ComCo operations in EAME. Europe in particular had always been perceived as the most important market for ComCo tractors. Therefore, managers still had the feeling of being fully in charge of ComCo with WorldCo being "over the pond" (director) and too far away to interfere.

ComCo was a highly functionally organised company, that operated what was described as "functional silos" (finance manager) such as marketing, management information systems (MIS), parts, production, purchasing and finance. Since there was a long tradition of functional silos, cross-functional cooperation and communications had always proved to be difficult. There was a lack of formal structure that forced different functions to work together. Any initiative or project that required cross-functional participation relied on informal ways of interacting. In that respect "it matters a lot who you know and how well you get on personally" (parts manager). Due to the frequent reorganisations in the

company's history and a low turnover of staff, organisational members in general had developed extensive social networks across the organisation.

The IS infrastructure was very much a reflection of the constant organisational restructuring initiatives ComCo went through over the last decades, which were described as a pendulum between decentralisation and centralisation. The oldest system was 25 years old and most of the systems since then were implemented in chunks as funding was available for that particular period. The IS infrastructure was referred to as a "Disney world" (IS manager) because of its jumble of different systems. Any software applications such as manufacturing or enterprise resource planning (ERP) software were highly customised to fit the actual processes at ComCo, which made upgrading particularly difficult. There was a lot of expertise in-house to configure software, and the MIS department had developed dominant IS development methodologies for the integration of new hardware and software. Compared to other agricultural equipment manufacturers, ComCo was one of the later adopter of new innovations. Here, an US competitor tended to take the leading role due to its strong technical orientation and its size, which provided sufficient resources for investment.

4.3 Integration of B2B e-Commerce at ComCo

This section provides a chronological description of the integration of B2B e-commerce between 1998 and the end of 2001 at ComCo.

4.3.1 Putting e-Commerce on the Organisational Agenda

About June 1998, people in different departments such as MIS, finance, and marketing separately became aware of e-commerce and realised that this would be something that ComCo had to consider. For example, the parts department considered having an application that allowed dealers to place orders online, whilst the wholegoods department wanted to give dealers the opportunity to register warranty claims online. However, it was

the marketing department, namely Martin Evans, that took the lead by building a ComCo website in order to put product information for the launch of a new tractor model online. The marketing department selected an external web design company called Web Factory to help them build a website as it was felt that the MIS department was "bogged down in formal procedures and therefore too slow to build new applications such as the website for the launch date" (marketing manager). In turn, the MIS department criticised the marketing department for not having consulted them and argued that the website would not fit into ComCo's overall legacy systems because it was not developed according to the traditional MIS methodology.

At the beginning of 1999, there were a lot of skilled people in different departments who "were searching for leadership on e-commerce" (purchasing manager). This leadership role was taken on by Robert Miles, a middle manager who worked previously in the MIS department and was then with the marketing department. He felt that "e-commerce activities needed to be approached more strategically". "Strategically" meant that e-commerce applications needed to be integrated with each other and with the legacy systems, to allow a continuous flow of information. In various informal and unstructured cross-functional meetings, people explored the potential for e-commerce at ComCo. After a presentation to senior management, Robert Miles was put officially in charge of setting up a strategic plan for an e-commerce initiative at ComCo, that could be presented to WorldCo management in the US for approval and financial backing. Further involved in the project was Eric Taylor who was a manager in the MIS department. His role was to assist with any issues where e-commerce applications would have an impact on the existing IS infrastructure.

4.3.2 Development of an e-Commerce Strategy

As it was felt that there was "not enough expertise in-house to develop an e-commerce strategy for ComCo" (IS manager), it was decided to bring in a consultancy. After talking

to five different consultancies, IBM Global Consulting was selected, not based on the consultancy package offered but on the fact that Robert Miles and Eric Taylor felt most comfortable with the main consultant fronting IBM, Ian Stevenson. Robert Miles said "So it was a personal choice. As with all the other…It is chemistry at the end of the day". Together with Ian Stevenson, Robert Miles and Eric Taylor planned a series of workshops, as depicted in Figure 4.2, to set the agenda and define business and technical requirements. The idea was to invite people from different departments and facilitate their interaction so that they would develop a coherent structure for the e-commerce initiative.

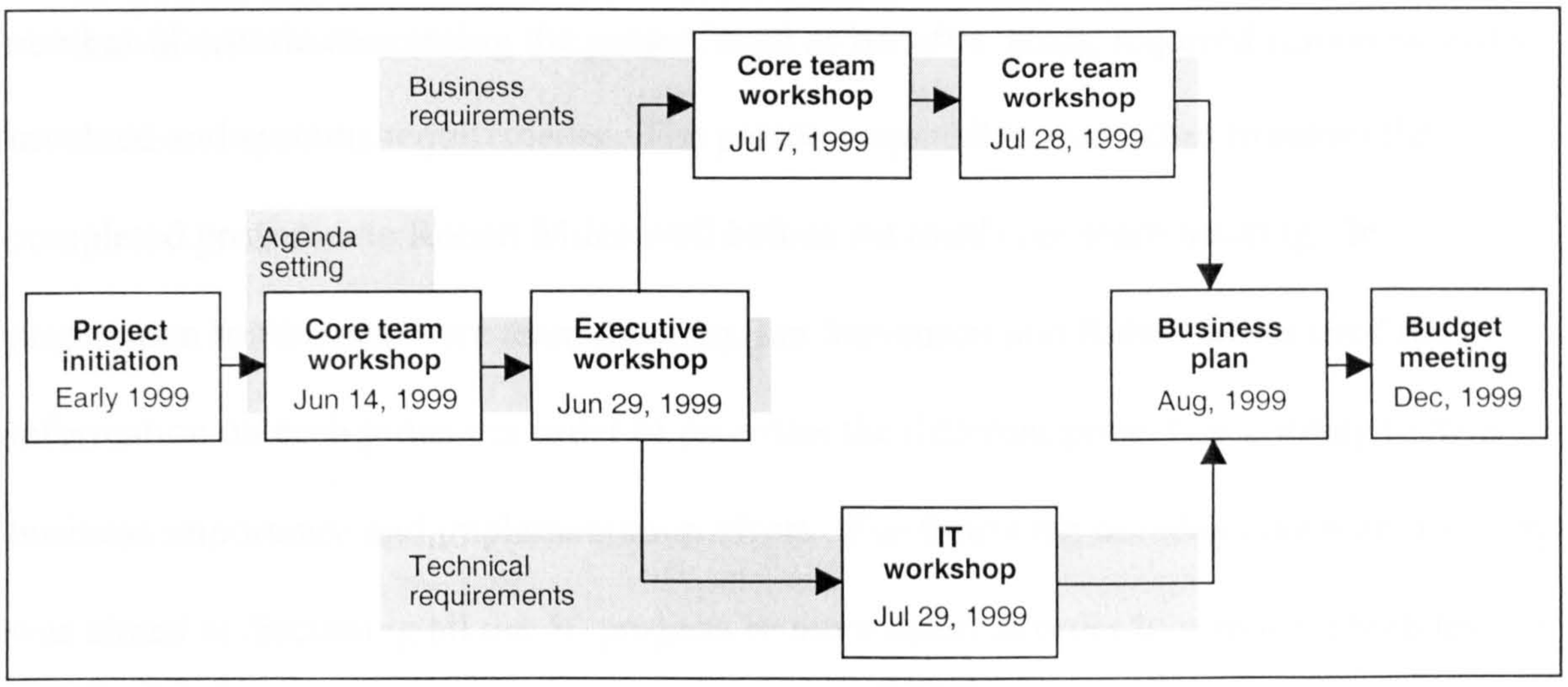


Figure 4.2: e-Commerce Strategy Development at ComCo

The agenda for e-commerce strategy development was set in a core team workshop and an executive workshop. The core team workshop was attended by middle and senior managers representing major functions within the company such as sales (2 people), marketing (5 people), agricredit (1 person), finance (1 person), MIS (2 people), manufacturing (1 person), engineering (1 person), parts (2 people), purchasing (1 person) and product reliability (1 person). As one attendee remarked "Hey, this is the first time for years that we sit together at the table and talk to each other". After presentations from Robert Miles and Ian Stevenson about the e-commerce, attendees were grouped in syndicate groups in order to develop a strategic 10-year vision of e-commerce, how it would affect ComCo and what the potential projects were likely to be. The IBM

consultants distilled the group output and a possible roll out of about 50 projects over a five-year period was devised. A one day executive workshop was held, attended by 16 senior managers of ComCo, to raise awareness about the impact of e-commerce on the agricultural equipment industry and introduce the 50 potential projects.

Business requirements were defined during two core team workshops. First, there was a half-day core team workshop to review the output from the first core team workshop and to give feedback from the executive workshop. To each of the approximately 50 projects, a person responsible was assigned, whose task was to fill in a two page A4 form that tested a number of criteria concerning the project such as benefits, costs, required resources, risks involved and systems requirements. The person responsible was asked to return the completed proforma to Robert Miles well before the third core team meeting. In preparation for the next core team meeting, Ian Stevenson and Robert Miles used the information on each project in order to prioritise the different projects according to their business importance and implementation effort. The following one-day core team meeting was aimed at discussing all the 50 projects in more detail in order to provide a high level of understanding for the three technical IBM consultants who took part. There was some discussion about the ranking as some people tried to advocate the projects that would benefit their department. At the end, there was another sequencing exercise to prioritise the most important e-commerce projects.

Technical requirements were defined in a one-day meeting between MIS representatives, IBM technical consultants, Ian Stevenson, Robert Miles and the researcher to analyse the legacy systems at ComCo and discuss the future infrastructure needed to implement the projects that had been identified in the core team and executive workshop. First, MIS representatives presented the structure of legacy systems. It became clear that the legacy systems were the product of an evolutionary process. Important characteristics were that some hardware and software were over 25 years old and all of the applications were

bespoke and tailored to the ComCo context. The IBM consultants emphasised the need to have up to date hardware and software to enable e-commerce applications and stressed the importance of standard rather than bespoke applications to make any future updates more easily. Among themselves the IBM consultants referred to the legacy systems as a "useless pile of junk" and strongly advocated basically rebuilding the complete IS infrastructure from scratch. The MIS representatives pointed out that ComCo would not have the money to make large-scale changes.

Based on the output of the different workshops and meetings, Ian Stevenson, Robert Miles and Eric Taylor put together a proposal for a ComCo e-commerce strategy that received the backing from senior management at ComCo. Senior management then put in a US$10 million budget proposal for e-commerce in December 1999, with US$5.7 million planned to be spent in the first year on infrastructure.

4.3.3 Rejection of e-Commerce Budget for 2000 by WorldCo

The proposal for the funding of the e-commerce initiative was not considered during the first round of WorldCo's budget meetings at the end of 1999. The first budget meeting was overshadowed by the poor business performance in terms of flat sales, and by organisational problems in the US. However, at that stage it became clear that WorldCo top management would not approve of the US$10 million budget for the e-commerce initiative at ComCo. WorldCo top management then asked senior management at ComCo what they could do with US$1 million in terms of e-commerce. Robert Miles and Eric Taylor went through a process to identify those projects that were possible and would provide quick wins. However, WorldCo top management decided at the beginning of 2000 that there was no corporate funding for an e-commerce strategy in 2000 at all.

Two reasons for the rejection of the e-commerce budget were frequently mentioned in interviews and conversations. First, the farm equipment industry was depressed and

WorldCo made losses. In this context, the main aim of WorldCo management was to make performance measures look as positive as possible. Rather than investing in new technology, savings could be made by cutting down expenditure. Therefore, WorldCo management was very reluctant to commit money to any project. Second, in hindsight people at ComCo felt that the e-commerce budget plan "did not speak the language of performance measures preferred by WorldCo management" (director). This would have meant to emphasise the return of investment of the e-commerce projects much strongly than was done in the budget proposal. People felt that "it was not enough to argue that it would be the right thing to do because of the general hype about the Internet" (IS manager).

4.3.4 Keeping the e-Commerce Initiative Alive

Without corporate funding, IBM ceased to be officially involved as a consultancy and it was impossible to pursue a strategic solution for e-commerce. The notion of a strategic solution was the integration of a modern IT platform which would allow running an integrated software solution for Internet, intranet and extranet applications. The e-commerce team felt it was important to keep the momentum going by pursuing a "semi-strategic approach" where tactical projects were used to produce an "strategic IS infrastructure that can provide a framework for expensive package solutions once the funding will be available in 2001" (Robert Miles). Tactical projects were considered "small piecemeal projects that would only hang together very loosely". This also meant involving consultancies or suppliers to get ideas and advice for the e-commerce projects, without starting any formal arrangements. It was acknowledged that "the disadvantage of the semi-strategic approach is that there might be problems in the future integrating applications because of sub-optimisation of individual projects" (IS manager).

The e-commerce strategy in 2000 was developed and coordinated on two levels within ComCo. There was a senior management steering committee at ComCo that approved

individual projects and set times for their development. However, the senior management steering committee provided only very loose guidance. Most of the strategy with regards to e-commerce was developed within the e-commerce team in which middle managers were instrumental in determining the strategic direction of the projects. Robert Miles continued to have a central role in pulling the scaled-down projects together and coordinating them in such a way that they would fit into the semi-strategic approach of the e-commerce strategy. Although the projects were set up with a project manager and a project team, Robert Miles got more deeply involved than his role as overall programme manager would suggest. His involvement was such that Robert Miles' name became synonymous with e-commerce at ComCo.

Although there was no official budget for the e-commerce initiative at ComCo, Eric Taylor from the MIS department "begged, borrowed and stole" resources from other MIS projects that were not running as quickly or spending as much money as predicted. That way, there was some capital of US$150,000 that could be spent on e-commerce related projects. Due to the rejection of official funding by WorldCo, there was a twisted constellation of e-commerce strategy-making in ComCo. Officially, there were no e-commerce projects taking place at ComCo as WorldCo did not provide any funding. Senior management at ComCo backed the e-commerce strategy but could not provide any funding for it. The little funding available came from other budgets that were controlled by different departments such as the MIS department. This meant that WorldCo could not exercise any influence on the e-commerce strategy because it was officially rejected and non-existent on a corporate level.

People involved in the e-commerce initiative were, on the whole, "pretty disappointed" not to be able to work faster and put e-commerce on a strategic basis. For example, Robert Miles felt that it was "very hard to be motivated" as there were only minor advances with very little real impact. He said that the e-commerce initiative should be considered as a

"big project" that has the support of top management and a solid strategy. He added that in order to make e-commerce applications work it needed change management to justify alterations in business processes and organisational structure. However, these change management initiatives needed to be backed up by top management as "they make things work because they want their investment back". Eric Taylor expressed his feelings by saying "It is very frustrating and as I said, they do have to find me a job next year". (In fact, this frustration may have led to Eric Taylor's unexpected retirement when it became clear that there would be no funding for e-commerce projects in 2001).

4.3.5 The Three Surviving B2B e-Commerce Projects

Despite the lack of funding and official support for an e-commerce strategy from WorldCo, a number of projects were pursued from the beginning of 2000 onwards as depicted in Figure 4.3. The projects differed in terms of the target groups and the technology used to interact with them. In terms of target groups, the e-commerce projects were aimed at three main stakeholders. There were about 250 suppliers in total for production and manufacturing of ComCo products and about 1500 suppliers for parts. ComCo sold its products through an extensive network of about 1500 dealerships in the EAME region. Finally, farmers presented the end customer for ComCo products. In terms of technology, different web-based network configurations were chosen to interact with suppliers, dealers and customers. ComCo with its legacy systems provided the central information hub where all relevant data about suppliers, dealers and customers were held. Extranets to suppliers and dealers provided a secure and closed network to exchange data with ComCo. The Internet was seen as an open network that customers could access in search of ComCo-related product and service information. In terms of B2B e-commerce, the supply schedule, the parts ordering and the dealer statement project were the only ones that were developed any further.

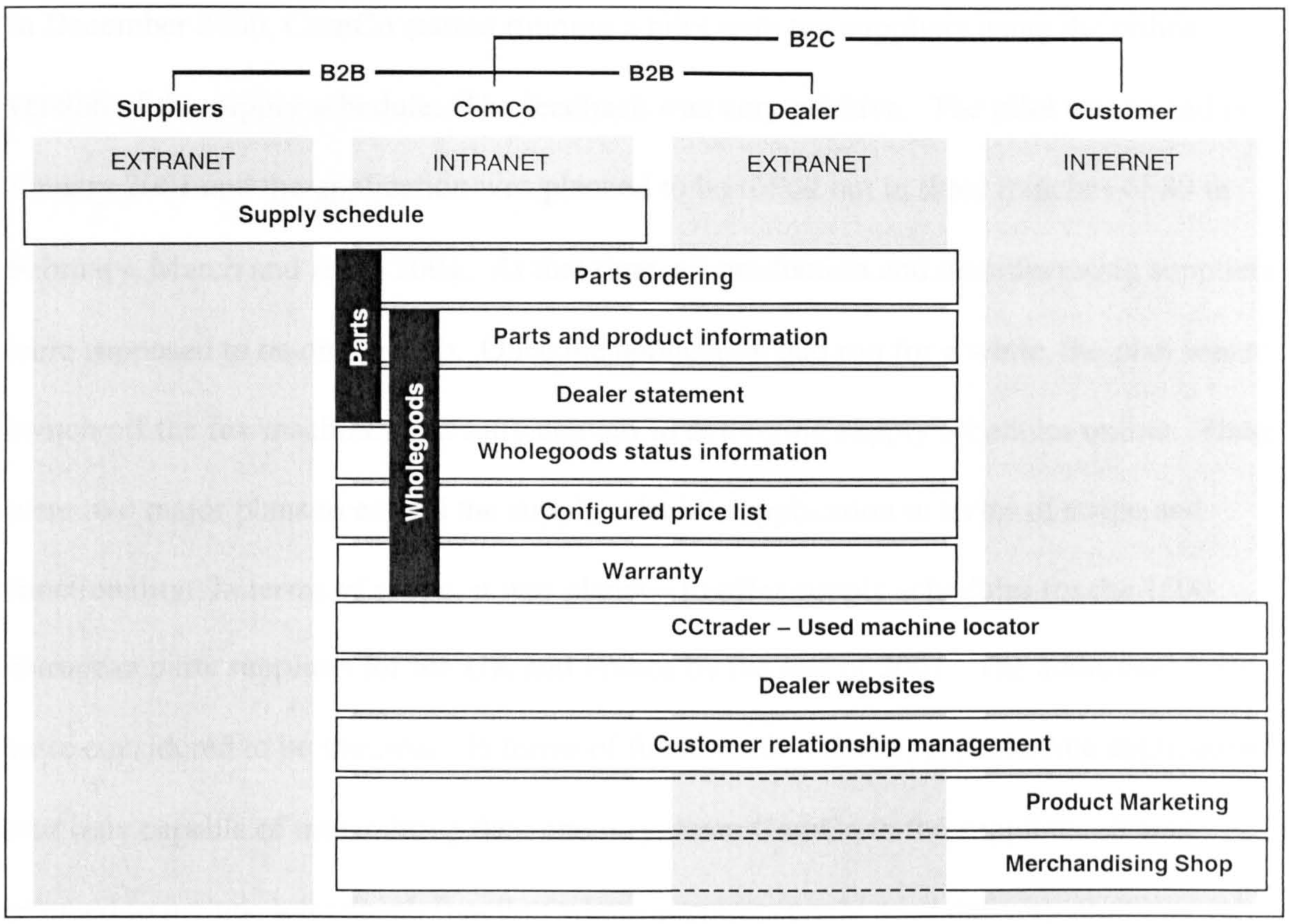


Figure 4.3: e-Commerce Projects at ComCo

The supply schedule project aimed at providing ComCo's 250 production and manufacturing suppliers with up to date information about the number of parts and their expected deliveries to the UK site. The then current practice of faxing supply schedules was cumbersome and often a cause for mistakes when suppliers had to retype the data into their production systems. Putting the supply schedules online aimed at avoiding the frequent supply shortages and improving suppliers' delivery performance. The development started in June 2000 and it was decided to develop the software necessary to bring the supplier schedule online in-house. The supply schedule project was seen as a pilot case for redesigning the overall IT infrastructure in order to provide better extranet management facilities. All in all, ComCo spent about US$90,000 on the IS infrastructure such as a database server, a web server, the firewall servers and the software associated with that. The amount of money was considered to be "relatively trivial compared to normal IS projects" (IS manager).

In December 2000, ComCo started running a pilot with ten suppliers using the online version of the supply schedule. The feedback was very positive. The pilot was to end in January 2001 and the application was planned to be rolled out in three tranches of 80 in February, March and April 2001. At that time, all production and manufacturing suppliers were supposed to be on the web. Once the application had run for a while, the plan was to switch off the fax machines and fully convert to delivering supply schedules online. There were two major plans to extend the supply schedule application in terms of scope and functionality. In terms of scope, it was planned to offer supply schedules for the 1500 European parts suppliers for the UK and France by the end of 2001. The additional costs were considered to be minimal. In terms of functionality, the supply schedule application was only capable of transmitting data one way, from ComCo to the suppliers. It was planned to include a feedback function where suppliers could send delivery promises etc.

The objective of the parts ordering project was to provide dealers with the option of ordering parts for ComCo products online. The MIS department decided in 1998 to build an online application that would reduce the workload for ComCo parts division to handle telephone calls, faxes and emails. For the parts ordering project, the selection of the application was determined by the existing legacy systems. ComCo used OASIS software from a British-based company called JBA for their parts environment. The MIS department needed the expertise of JBA to write the necessary codes to allow the interaction between the dealers and the parts database to happen. However, "JBA was not particularly interested in taking on this job because the standard OASIS software which ComCo used was bespoke and therefore JBA needed to produce the codes especially for ComCo without the chance to sell these codes to anybody else" (IS manager). In the last quarter of 1998, ComCo and JBA kicked off this project. JBA committed only one consultant to the project. ComCo pushed hard to make JBA deliver the right level of codes that were useful for the interaction.

In March 2000, JBA handed over the codes. When the MIS department tested the codes, the software had lots of bugs and a number of problems. JBA had to rework part of the software. In November 2000, ComCo started a pilot with two dealers using the web-enabled JBA software. Although, the MIS department was satisfied overall with the level of transaction enabled by the software, two major problems arose. The first major problem was the issue of maintenance, as there were no back office systems with Internet-based browsers that would allow an easy update of the website content. The second major problem was related to the fact that the software JBA wrote for ComCo no longer represented the way the MIS department wanted to organise the systems. The reason for that was that the MIS department developed a better understanding through 2000 as to how the IS infrastructure would need to be redesigned for future e-commerce applications. Consequently, the MIS department decided to re-engineer the JBA software, although there were no immediate resources for further development.

The aim of the wholegoods project, the third B2B e-commerce project, was to provide the dealer with any kind of information related to the ordering process for wholegoods e.g. tractors and combines. To start with, dealers needed up-front product information, in order to be informed and to talk knowledgeably about ComCo products to customers. Then, they needed to be able to configure a product with the specifications required and to be given a price they could quote to customers. Once the customer had chosen a specific product, the dealer needed status information such as product availability and order tracking. In addition to the order processes, a dealer needed to know about their account status with ComCo. The MIS department wanted to use the wholegoods project as a pilot to look at a Compuware product called "Uniphase" to see whether it could be used to bring the back office systems online. The MIS department decided that they wanted a very simple application so that they could concentrate on the technological feasibility of the software product. Therefore, they chose the dealer statement which was perceived to be a "fairly

straightforward" application so that they could concentrate on the technological capability of the software.

Due the lack of financial resources, and its special knowledge of ComCo legacy systems, the MIS department decided to make the necessary changes to the Uniphase software in-house. In order to evaluate the Uniphase software, the MIS department needed to buy an evaluation copy for £30,000 which was a big part of the annual budget for the e-commerce projects. At that stage, it was felt that Uniphase was the right product to do the work. The MIS department managed to build the application and put the dealer statement on the web. However, the problem was that the Uniphase software did not seamlessly integrate with the JD Edwards software because of date format problems. Although there were ways around it to make it work, it was felt that the Uniphase software would not give the productivity gains that the MIS department was looking for. The MIS department concluded that the Uniphase was unsuitable to fit into the JD Edwards environment and the £30,000 investment was written off "as an experience thing" (IS manager) and Uniphase was never put into operation. The plan was to find another solution to link the back office with the Internet to produce an online dealer statement in 2001.

Up to the beginning of 2001, which is more than two years from the start of the e-commerce initiative, the usage of B2B e-commerce applications at ComCo was very limited with the exception of the supply schedule. Both the parts ordering and the dealer statement project progressed up to the pilot stage and it was decided then that it would not be rolled out to the dealers. Although this gives a very bleak picture of implementation of B2B e-commerce applications in general, ComCo was successful in implementing the "CCtrader.com" website and extending its public Internet site with a news section. However, "the big success story", from the ComCo perspective, was the supply schedule project. Although the supply schedule project was not fully rolled out to dealers, it was heralded as a big success for the e-commerce effort at ComCo and, in particularly, for the

MIS department. Not only did they develop a fully functional online version of the supply schedule but they also put a crucial cornerstone in place for putting back office data online. This was seen as the foundation for other extranet applications, particularly on the dealer side, that could be rolled out more quickly as the basic IS infrastructure was in place.

4.3.6 Rejection of the e-Commerce Budget for 2001 and Senior Management Intervention

At the end of 2000, Robert Miles put together a new proposal for an e-commerce budget for 2001 which "was basically a revamp of the e-commerce strategy suggested for the previous year". The budget was US$3 million for capital expenses and US$2 million for operating expenses. It was a 5 year plan with break even in year three. In contrast to the budget proposal for 2000, the 2001 proposal tried to avoid the previous year's shortcomings. First, the e-commerce strategy made a strong financial case for the investment to justify the return on investment. Second, ComCo took the e-commerce project out of the MIS project costing and placed it separately as a business project. This was done to signal the importance of e-commerce for improving business and dismiss any associations of e-commerce being a solely technical project. The e-commerce budget was approved by senior management at ComCo.

However, the proposal for funding the e-commerce initiative in 2001 was rejected again by WorldCo due to the continuing recession in the farming equipment industry. Instead, a senior vice president for sales and marketing in EAME was key in organising funding within ComCo for e-commerce in 2001. At the beginning of 2001, Robert Miles "looked again for resources to keep the e-commerce project alive and the resources in the MIS department were not sufficient to do that". Resources from the MIS department came from freeing someone up from other projects. This was done by, for example, outsourcing some software development or by an off-the-shelf application. Robert Miles then pulled all the different initiatives together ("who did what where") and he gave a presentation on the

different e-commerce projects and demonstrated their benefits for the different functions at ComCo. The senior vice president then pushed the different functions to contribute to the e-commerce effort and the money was put into a budget pot. The only function that did not participate was the purchasing department who felt that there were no projects from which they would benefit.

4.3.7 Improvement of Existing Functionality and Focus on WorldCo.net

In 2001, the focus of the B2B e-commerce strategy was on improving existing applications such as the supply schedule and dealer applications, which were then summarised under the heading of "WorldCo.net". The supply schedule project was the most advanced, with 50 per cent of the production suppliers using the application in November 2001. The aim was to have 100 per cent of suppliers using it by the end of 2001. John Payne said "ComCo has put its all eggs in one basket now", as 30 suppliers solely relied on the online supply schedule. The short-term goal was to discontinue the use of faxes to suppliers and therefore there would be a 100 per cent reliance on the new technology. Besides bringing more parts suppliers in, the aim was also to roll out the supply schedule to the suppliers for the Beauvais manufacturing facility. This was perceived as relatively easy as information that was sent to suppliers was all hosted on the ComCo site in the UK.

The other focus of the B2B e-commerce strategy was on the dealer applications, which eventually would be marketed to dealers as WorldCo.net. These projects comprised of all the individual dealer applications including parts ordering and account information and WorldCo.net sought to bundle it into one service tool for ComCo dealers. The idea was that WorldCo.net would finance itself as ComCo would charge dealers about £200 annually for using the applications. The argument was that dealers would save considerable time by using the applications compared to conventional ways of interacting with ComCo such as telephone or post. Although the second quarter of 2002 was the

expected launch date for WorldCo.net, individual applications were already behind schedule.

At the end of 2001, the B2B e-commerce projects had made different progress. The wholegoods status information project was not developed at all, as it was technically impossible to access the back office. The configured price list project had been on hold because the required software was thought to be too expensive to purchase. The warranty project had not progressed, because JD Edwards could not deliver the online functionality to the project. Although the parts ordering project had been postponed quite frequently due to problems with the software vendor, it was in a pilot stage with a few dealers and there were plans to roll it out to a greater number of dealers at the end of the year. Similarly, the parts and product information project was in a pilot stage with four dealers testing the application, with an estimated roll out date of mid 2002. The dealer statement project was estimated to be rolled out by January 2002 with a basic functionality to bring dealer statements, direct debits links and reminders online.

4.4 Knowledge Creation

This section provides a thematic account of the process of knowledge creation during the integration of B2B e-commerce.

4.4.1 Strategies for Knowledge Creation

During the integration of B2B e-commerce, the strategy for knowledge creation changed from a blackboxing strategy to a version of the prisoner strategy, each with distinctive features in terms of source of knowledge (Scarbrough, 1995). Up to the end of 1999, ComCo adopted a blackboxing strategy by drawing on consultancy expertise in order to learn quickly about potential e-commerce applications and to develop an e-commerce strategy. IBM presented a very "generic notion of e-commerce" (purchasing manager) that was tailored during the workshops to fit the specific ComCo context. This can be

explained by the internal demand for knowledge in order to learn quickly about potential technological solutions and their application for business. At that stage, valuable knowledge was perceived to be available outside the organisation such as technology and the expertise of how to use this technology. By involving a large consultancy such as IBM, the learning process could be "speeded up in order to catch up with the latest technological development rather than relying solely on in-house know-how" (director). Organisational members were aware that ideas and suggestions had a strong "IBM flavour" (Robert Miles) as the consultancy tried to sell its products and services.

During the development of the e-commerce strategy in 1999, the main source of knowledge was external expertise in the form of consultancy services from IBM. IBM was perceived to have "practical experience with other manufacturing companies from which ComCo could benefit. We [ComCo] are talking about lessons learned and best practices" (purchasing manager). There were a number of areas ComCo felt that they needed to learn more about. First, ComCo was able to gain a valuable understanding of potential e-commerce applications which was an area where ComCo did not possess any previous knowledge. Second, there was a need to know that these e-commerce applications would fit into the context of ComCo, in terms of linking with legacy systems and business processes. Third, in order to put together a budget proposal for an e-commerce strategy, it was important to get an estimate of the implementation cost and the return on investment.

Due to the rejection of the e-commerce budget, there was a change in the strategy at the beginning of 2000 by focusing more strongly on internal knowledge creation. Although the blackboxing strategy was still the preferred approach in order to implement B2B e-commerce applications quickly, there was no money to pay for extensive external products and services. Instead the approach was to rely on in-house software development and careful purchase of hardware and software. Although this strategy strongly resembled the prisoner strategy in that it secured exclusive control of the innovation outputs, there were

no organisational processes put in place to bind people with expertise more strongly to the organisation. The lack of funding and top management recognition, made it a particularly "soul-destroying and frustrating experience" (Robert Miles) for these individuals. As a result, ComCo lost Eric Taylor and with him large areas of knowledge about the impact of e-commerce on the IS infrastructure, and one of the major driving forces behind the e-commerce initiative. Similarly, the various people working in the MIS department did not receive any formal recognition of their work.

Whereas in the early phase of the innovation process, the main source of knowledge was consultancy expertise, in the later phase in-house functions, particularly the MIS department, developed the necessary knowledge to put the different applications into place. For the supply schedule project, a software development team wrote the necessary codes to bring the data from the MRP system online. For the dealer statement project, the MIS department bought an off-the-shelf product that was configured in-house to link it to the legacy systems at ComCo. In the case of the parts ordering project, the main source of knowledge was an external consultant from JBA who wrote the software codes. The reason for the changing mix of knowledge sources was associated with the highly bespoke legacy systems at ComCo. Any new software and hardware had to be tailored to the existing systems. The typical way ComCo approached this challenge was to "purchase software, have software suppliers showing us [ComCo] how to work with the software and then off we go on our own" (IS manager). Once people within ComCo possessed this capability, in-house development became the main source of knowledge creation.

Despite the different strategies, knowledge creation was mainly based on planned activities. Knowledge about e-commerce applications tended to be complex and highly specific. As knowledge in form of artefacts such as hardware and software was not freely available, any acquisition from external sources tended to be accompanied by a commercial transaction which introduced a high level of formality in terms of agreements

about specifications, service duration etc. In-house development also relied on traditional project development methodologies, which prescribed a formal approach to all IS developments.

4.4.2 Technological Frames

Potentially, there were a number of social groups that might have different assumptions, expectations and knowledge in the understanding of the technology (Orlikowski and Gash, 1994). The groups included top management at WorldCo, senior management at ComCo, the e-commerce project team at ComCo, and dealers and suppliers who would use the B2B e-commerce applications. Practically, however, there were only limited empirical findings that can explain technological frames of the groups involved. The reason for that was twofold. First, at the time of the data collection, the B2B e-commerce projects were not fully rolled out to users, ComCo's suppliers and dealers. However, an interview with a dealer of CNH who had substantial experience with using similar types of B2B e-commerce applications to those which ComCo wanted to roll out in the future, might give some indications. Second, it was not possible to conduct interviews with top management at WorldCo. Here, some accounts of senior managers at ComCo might indicate some assumptions of top management at WorldCo, although it would not be sufficient for a full account.

Based on the technological frames identified by Orlikowski and Gash (1994) and Barrett (1999), assumptions and expectations of the e-commerce project team, top management at WorldCo, and dealers, will be outlined. The e-commerce project team presented one group that shared the same technological frames. In terms of technology strategy, team members felt that ComCo needed to "embark on e-commerce as other manufacturing companies, including competitors, reaped the benefit from automated information distribution and cost savings" (Robert Miles). With regards to the nature of technology, team members perceived e-commerce as a technology offering "genuine new opportunities to

electronically integrate ComCo's supply chain" (Eric Taylor). Concerning the technology in use and the impact on existing relationships with suppliers and dealers, team members understood B2B e-commerce as linking external partners with internal databases to automate transactions, rather than to change existing relations as "ComCo unfortunately does not have the power to rule the supply chain. We [ComCo] are too small a fish ourselves" (purchasing manager).

From informal conversations with senior management at ComCo, it appeared that top management at WorldCo had quite different expectations and assumptions about B2B e-commerce. In terms of the nature of technology, top management at WorldCo rejected the e-commerce budget twice on the grounds that there were no strong enough financial reasons, such as a proven return on investment, for providing up-front funding of new applications. With a main focus on performance figures and little experience of a manufacturing background, top management at WorldCo apparently had few or no assumptions or expectations about the functionality and the day-to-day operation of B2B e-commerce as they "basically did not understand what all this was about" (director).

An interview with a major CNH dealer, owning three dealerships in central England, might provide some limited indications for potential technological frames when B2B e-commerce applications are rolled out. In terms of the technology strategy, the dealer extranet was seen as a way to automate and speed up transactions between dealers and the manufacturer. Concerning the nature of technology, the dealer saw the new technology as offering useful functionality from which farmers would benefit through, for example, faster parts ordering. Regarding the technology in use, employees took up the dealer extranet quickly and worked with it daily. The point was made that the dealer extranet did not affect mechanisms for interorganisational cooperation such as personal relationships or trust, but is seen rather as enabling more efficient communication.

4.4.3 New Technology and Interpretive Closure

B2B e-commerce was perceived as "exciting new stuff" (finance manager) that possessed the properties of new technology, triggering intense sensemaking processes (Weick, 1990). The development of an e-commerce strategy and the roll out of the B2B e-commerce projects presented a permanent source of uncertainty to organisational members involved. For example, the strategy had to be revised twice after the rejection of the e-commerce budget, which meant that ComCo "had to start from scratch twice" (IS manager). Equally, the B2B e-commerce projects, such as the parts ordering and dealer statement projects, proved to be unpredictable as the MIS department experienced "continuous learning about effects on business processes and the legacy systems" (IS manager) during the innovation process. The B2B e-commerce projects showed a high degree of continuity as they sought to connect ComCo with its suppliers and dealers. The major aim was to link external partners in the EAME region with internal databases at ComCo. B2B e-commerce at ComCo required a degree of abstraction as the technology was aimed at replacing existing paper-based transactions and material with an electronic version. For example, data was presented on screens rather than in printed material. Equally, electronic transactions aimed at reducing human interaction between external partners and ComCo employees, as there was no need to telephone in and talk to people in person.

At the beginning of the innovation processes when individuals became aware of e-commerce, sensemaking about the new technology was, overall, fairly limited. Although some individuals "woke up to e-commerce" (Martin Evans) and realised that it "would be something that ComCo had to consider", there was not yet a momentum in the organisation. However, with the formal start of the e-commerce project, sensemaking intensified significantly. After the launch of the official e-commerce initiative, e-commerce was perceived by representatives of different departments as novel, and there was a deliberate initiative to draw attention to the topic by having cross-functional

workshops facilitated by an external consultancy. The workshops proved to be an organisational platform for sensemaking, in order to understand what e-commerce meant and how it could affect ComCo. At that stage, assumptions and expectations of e-commerce at ComCo were more clearly defined by the various groups.

The rejection of the e-commerce budget at the end of 1999 triggered renewed sensemaking as initial plans needed to be revised completely. However, sensemaking was limited in its ability to change the understanding of e-commerce, as ComCo "still wanted to pursue an integrated approach to e-commerce and roll out as many projects as possible" (John Payne). Instead, assumptions about the right methodology and expectations about what could be done on a semi-strategic level changed. On an operational basis, sensemaking was intense as the e-commerce project team continued to "learn every day about e-commerce and how it hangs together" (IS manager). The managerial intervention after the second rejection of the e-commerce budget for 2001 presented a further unexpected event that triggered renewed sensemaking. It raised the expectations of the e-commerce project team as the funding enabled them to "do more projects differently" (IS manager). However, there was still the assumption that the strategic roll out of an integrated solution was the ultimate aim as "the semi-strategic approach is only a makeshift solution until funding is available".

4.5 Knowledge Sharing

This section provides a thematic account of the process of knowledge sharing during the integration of B2B e-commerce.

4.5.1 Importance of Community of Practice and Social Networks for Knowledge Sharing

A community of practice and internal social networks appeared to be the most important for knowledge sharing (Brown and Duguid, 1998; Hansen, 1999). As depicted in Figure 4.4, the community of practice developed out of the e-commerce project team consisting of

Robert Miles, Will Robinson and Eric Taylor, who was later replaced by John Payne. In addition, Martin Evans, a middle manager in the marketing department, was a member due to his early involvement in the ComCo public website, which was the first e-commerce related project at ComCo. One director said that "if you talk about e-business here, you talk about Robert [Miles], Will [Robinson], Eric [Taylor] or later John [Payne] and Martin [Evans]". Their relationship can be understood as a community of practice as the members engaged in informal activities beyond their involvement in the project team (Lave and Wenger, 1991). The B2B e-commerce initiative was first and foremost driven by their personal initiative, which went beyond normal work commitment, as e-commerce "derived from a grass-roots movement" (Eric Taylor) with high levels of personal project ownership. The interaction of the community of practice relied mostly on informal, ad-hoc meetings and conversations, to discuss the direction of e-commerce at ComCo. Although the community of practice overlapped with the formal project team structure, it largely organised itself due to the lack of senior management involvement (Brown and Duguid, 1998).

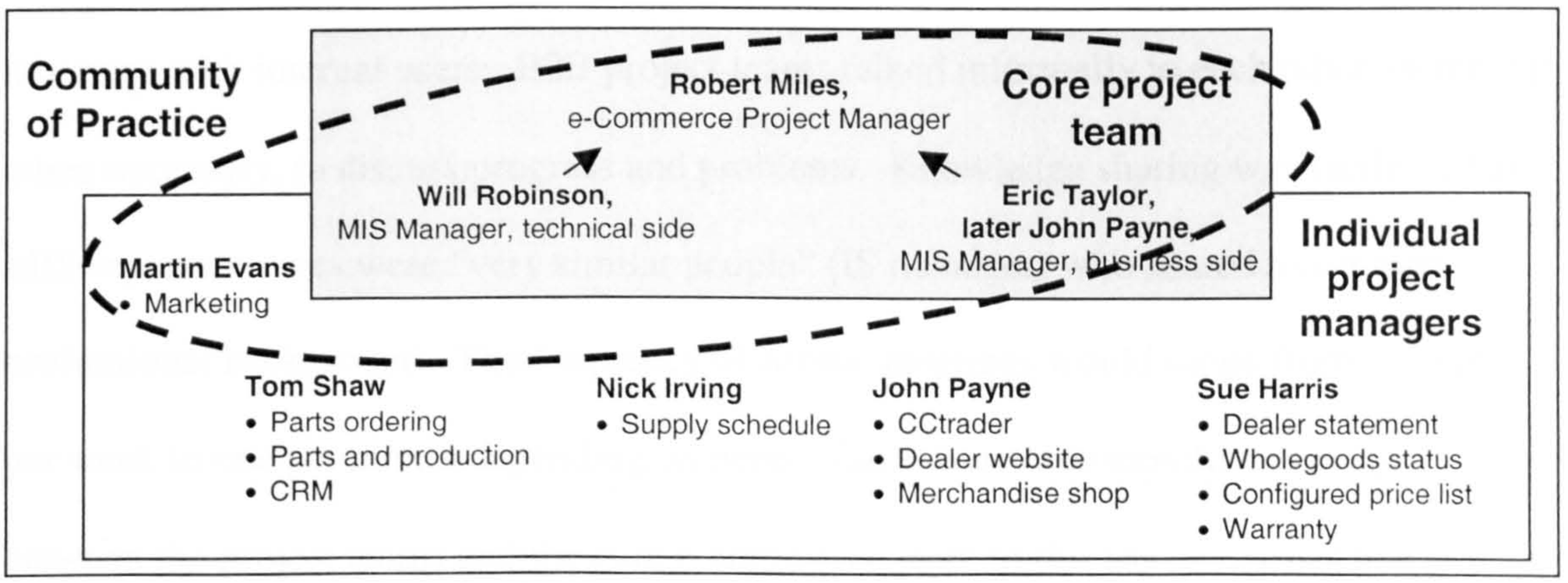


Figure 4.4: e-Commerce Project Team and Community of Practice at ComCo

Since the e-commerce initiative lacked corporate support and consequently a large scale roll out, internal social networks were vital for cross-functional cooperation (Hansen, 1999). Informal networks were the main means of communications between "functional silos" as they provided "the best way to find out what others are up to and to get things

done" (purchasing manager). For example, on a programme management level, Robert Miles utilised the informal networks he had built over time at ComCo, to win support and coordinate departmental support in the absence of formal hierarchical management relations. As Robert Miles used to work in the MIS department and was now affiliated to the marketing department, he was able to bridge the gap between the technical side, e.g. the MIS department and the user side, such as marketing. Due to the frequent restructuring and the low turnover at ComCo, informal networks consisted of employees at ComCo who knew each other from previous projects or from having worked together. There were formal meetings with senior managers at ComCo to keep them updated on e-commerce development.

On a project level, there were project teams whose responsibility was to build the e-commerce applications. Ideally, project teams consisted of representatives from the business and MIS side. However, in the case of B2B e-commerce projects, the project teams were led solely by MIS representatives, as business support was subdued due to the lack of official backing by WorldCo. Business requirements were defined in formal meetings with internal users. B2B project teams talked informally to each other, or met up when necessary, to discuss progress and problems. Knowledge sharing was facilitated as MIS representatives were "very similar people" (IS manager) who shared a common professional background. The frequency of formal meetings would range from a couple per week to one per month depending on need. There were also monthly meetings between the project teams and the core e-commerce team to discuss any issues that had emerged.

Formal work groups were mainly involved in a series of five formal workshops to select specific e-commerce applications and specify their business and technical requirements. Workshops were chosen as they presented an opportunity to bring in representatives of different departments and make them talk to each other. Great emphasis was placed on the

facilitation of communications and activities during the workshops, so that representatives could understand each other and exchange ideas. An external IBM consultant, Ian Stevenson, took on the role of facilitation, as he had considerable experience in that field and was perceived to be a neutral outsider. On the whole, it was felt that "people really talked to each other, something which did not often happen at ComCo" (parts manager).

4.5.2 Different Roles of Planned and Emergent Activities for Knowledge Sharing

Throughout the integration of B2B e-commerce, there was a changing emphasis on emergent and planned activities for knowledge sharing. During the cross-functional workshops, and after the managerial e-commerce review, there was an emphasis on planned activities. Planned activities involved bringing representatives of all functions physically together and exchanging ideas about the direction of B2B e-commerce projects. While the cross-functional workshops to develop an e-commerce strategy appeared to enable a high level of knowledge sharing, the workshops after the managerial e-commerce review were far less intense. The first set of cross-functional workshops was perceived by the participants as an opportunity to come together as an organisation in order to address a challenge that would be common to all functions. One participant mentioned that it was the "first cross-disciplinary workshop for years where we worked together" (manufacturing manager). The set-up of the workshops and the moderation by Ian Stevenson helped to create an atmosphere where knowledge sharing was encouraged through activities such as brainstorming sessions and prioritisation activities.

In contrast, the second set of workshops after the management e-commerce review lacked the atmosphere of achieving a common goal. Since functions were made to contribute financially to keep the e-commerce projects going, representatives went into the workshops thinking "what is in it for us" (marketing manager). The functional division became apparent again and subdued knowledge sharing. However, the benefit of the second set of workshops lay in informing a wide range of organisational members on B2B e-commerce

related issues. A participant said that "it was more of an info show than sketching out a common strategy" (parts manager).

Emergent activities for knowledge sharing were dominant before the official start of the e-commerce initiative and after the rejection of the e-commerce budget. Emergent activities included informal conversations about e-commerce with colleagues and informal meetings to discuss specific issues, as it was very easy to "pop into someone's office" or "have lunch together in the canteen" (IS manager). Social communities facilitating knowledge sharing were internal social networks before the official start of the e-commerce initiative, and later also the community of practice which had developed during the integration of B2B e-commerce. Knowledge sharing in the social networks and community of practice was intensive and frequently quoted as the main source of information about "what's going on right now".

These common objectives to pursue an e-commerce strategy provided a strong enough reason to overcome functional boundaries and engage in knowledge sharing. Before the official start of the e-commerce initiative, people had the common objective of putting e-commerce on the organisational agenda. After the rejection of the e-commerce budget, people were driven by the idea of keeping the e-commerce initiative going despite the lack of financial support. Yet knowledge sharing was limited to the members of the social networks and community of practice and thus only involved a small part of the organisation, as "it really matters who you know" (finance manager). Effectively, a great number of organisational members were excluded from knowledge sharing.

Both planned and emergent activities were based on face-to-face interaction rather than the use of ICT. Organisational members used more traditional communication technology such as the telephone to coordinate meetings or to have a short conversation. ComCo did not have an intranet and there were severe technical problems with using emails internally.

There were no immediate plans to introduce ICT either within ComCo or within WorldCo. Social interaction was facilitated by the co-location of different functions. All functions were on the UK premises. Although some groups of departments occupied different buildings on the premises, there were common areas such as the canteen where people would run into each other. There was also a constant flow of people between departments. Face-to-face conversations were always favoured over telephone conversations and emails, due to the perceived ease of "pop[ping] into someone's office" (IS manager). Knowledge sharing was predominantly a social process rather than relying on ICT.

4.6 Knowledge Retention

This section provides a thematic account of the process of knowledge retention during the integration of B2B e-commerce.

4.6.1 Planned and Emergent Activities for Knowledge Retention

There were periods during the integration of B2B e-commerce when knowledge retention was dominated by either planned or emergent activities. Between the official launch of e-commerce and the budget rejection, knowledge retention was largely planned. Planned activities were mainly achieved through the establishment of an e-commerce project team and the cross-functional workshop. The selection of the e-commerce project team members identified the organisational members who would learn most extensively and therefore retain most knowledge about B2B e-commerce. The function of the cross-functional workshop was not only to share knowledge more widely within the organisation, but also to facilitate knowledge retention. Particularly at that early stage, knowledge retention was intensive as project team members and workshop participants had a genuine motivation for learning about e-commerce. The high intensity of knowledge retention parallels high levels of knowledge creation and sharing at that particular point.

Planned activities resulted mainly in knowledge retention both in schema and information (Stein, 1995). Schema were strongly influenced by affiliation to organisational functions. For example, people in the marketing department saw the Internet as an exciting new tool to reach out to customers. People from the MIS department perceived e-commerce as a way to extract back office data and bring it online. The e-commerce team around Robert Miles shared belief structures as to how e-commerce would affect ComCo and how it could be integrated. Apart from written documentation held mainly by Robert Miles in the form of PowerPoint slides and Word files, shared information systems such as databases only played a minor role in the innovation process. Written documentation was used during the development of the e-commerce strategy. It started with Robert Miles' initial proposal to senior management at ComCo for initiating e-commerce, detailed workshop documentation, and the final e-commerce budget proposal for WorldCo. On the whole, organisational members agreed that ComCo "is not really good at preserving experience on an organisational level" (director).

Before the launch of the e-commerce project and after the rejection of the budget, knowledge retention relied on emergent activities. Prior to the start of the e-commerce project, individuals in different functions started to be interested in the issue of e-commerce. As it was not part of their regular job, any learning and knowledge retention occurred randomly. For example, individuals would read about e-commerce in daily newspapers such as The Financial Times or advertisement flyers from software and hardware consultancies. In addition, individuals in the marketing department such as Martin Evans familiarised themselves with general issues such as application hosting. At that stage, knowledge retention was individual rather than collective.

Knowledge retention also relied on emergent activities after the rejection of the budget. Particular experts who were members of the community of practice played an important role in retaining knowledge, in two ways. First, experts extended their professional

knowledge. For example, Robert Miles expanded his expertise in project management to take account of the semi-strategic nature of the e-commerce projects. He learned how to allocate resources across the range of projects in order to keep them alive. Will Robinson became an expert on the technical infrastructure needed by e-commerce applications. This expanded his professional expertise in the management of the legacy system at ComCo. In addition, social networks proved to be important for knowledge retention. Members of the community of practice built on their existing social connections in ComCo to be able to draw on other people's expertise. For example, John Payne knew who to ask if he needed answers to technical or organisational questions. Also, knowing who is important for what, helped to keep the e-commerce initiative alive. Robert Miles, for example, knew to whom to turn to get informal support for individual projects and how best to present his agenda to specific people.

Collective knowledge retention, however, was largely limited to the members of the community of practice. The only significant knowledge retention on a collective level was in physical systems such as the IS infrastructure and in the ability to change them. Despite limited resources, ComCo actually managed to produce software and hardware that enabled the MIS department to interface the back office data with the Internet and to protect internal data, through firewalls, from outsiders. Also, individual programmers and systems managers were able to produce new software codes and configure hardware to implement changes to the legacy systems. Such expertise was created through learning by doing. However, such expertise was on an individual rather than collective level. Due to the scale of the e-commerce roll out and the choice of applications, there were no changes to organisational structure and business processes.

4.6.2 Organisational Routines

Retained knowledge in individual and collective routines had significant influence on the dynamic of knowledge processes during the integration of B2B e-commerce. On an

individual level, personal routines played some role in organising the e-commerce initiative. For example, the e-commerce initiative reflected Robert Miles' style of project management, which was described as being very careful, step-by-step, and involving getting approval of senior management at ComCo. Also, the lack of cross-functional cooperation after the rejection of the e-commerce budget was attributed to Robert Miles' leadership style. For example, for the dealer application project in 2001, he organised cross-functional workshops to define objectives, requirements etc. However, once Robert Miles had got the things out of the workshop he needed to progress on the project, cross-functional collaboration stopped.

On a collective level, operating procedures such as IS development methodology were applied by the MIS department in the roll out of e-commerce. The IS development methodology reflected "the way we [ComCo] do things here" and was seen to "encapsulate the experience of MIS project management" (IS manager). This methodology stemmed from previous experience in the integration of new IT, and emphasised scalability and consistency over quick pilot projects. Scalability referred to the ability to extend applications so that they would fit into the whole organisation. For example, for the dealer website, it was important to keep a consistent image, which takes much more thought about future issues such as corporate design, maintenance etc. Consistency referred to the ability to pull applications together and make them link up with other systems. Any new application had to be integrated into the existing legacy systems, which were over 25 years old in parts. Consequently, the development of B2B e-commerce applications was not only slow because of the lack of resources, but also because of the IS development methodology.

4.7 Framework for the Analysis of Knowledge Processes

Building on each of the three knowledge processes, this section provides a thematic account of those findings, which can be related to the understanding of knowledge in IT-based innovations in general.

4.7.1 Dynamic of Knowledge Processes

The findings suggest three main characteristics of knowledge processes. First, processes of knowledge creation, sharing and retention were ongoing and occurred simultaneously throughout the integration of B2B e-commerce. For example, knowledge was created during the full duration of the innovation process, first on an individual basis, then in conjunction with IBM and later mainly though in-house development. Knowledge sharing started through informal conversations, was then formalised through the introduction of a project structure, and later occurred particularly in the community of practice and in social networks. Knowledge was retained through codification and later by technology, experts, and their social relations. Due to the ongoing and simultaneous nature of knowledge processes, it was not possible to associate knowledge processes with any specific period in the integration of B2B e-commerce.

Second, although knowledge processes were ongoing, they varied in intensity during the integration of B2B e-commerce. All three knowledge processes showed low intensity prior to the launch of the official e-commerce initiative reflecting the emergent activities. After that knowledge creation remained high during the innovation process as e-commerce "poses an ongoing challenge in terms of learning, due to the ever increasing functionality of the technology" (IS manager). Knowledge sharing was most intense during the strategy development, and organisational members felt that they "communicated really well in ComCo" (marketing manager). While knowledge sharing within the community of practice and in social networks remained high after the rejection of the e-commerce budget, it was low among other organisational members as they "retreated to their functional silos and stopped talking" (purchasing manager). Knowledge retention tended to be fairly weak throughout the innovation process as ComCo "is not really good at preserving experience on an organisational level" (director).

The third main characteristic is the interrelation of knowledge processes. Knowledge processes worked, not in isolation, but in connection with each other. For example, knowledge processes were strongly related during the series of cross-functional workshops for strategy development. Knowledge sharing among the functional representatives influenced how knowledge was created. A parts manager said that "because we [the participants] were talking to each other, we were pulling in the same direction". Also, because participants felt that they "learned and achieved a lot", they retained knowledge about this experience. Because knowledge processes were interrelated, the question for this research was to look further for potential reasons of such interrelation. The next two sections will look at this in more detail.

4.7.2 Knowledge Phases as a Concept to Understand the Interrelation of Knowledge Processes

At this point, the concept of "knowledge phases" is introduced as it helps in understanding the interrelation of knowledge processes during the integration of B2B e-commerce. The knowledge phases, as depicted in the upper part of Figure 4.5, can be defined as periods of time during the IT-based innovation in which the relationship between all three knowledge processes are based on a stable pattern of organisational activities. For example, the period between the budget rejection and the managerial e-commerce review saw a strong reliance on planned activities for knowledge creation (e.g. through formal in-house development), and on emergent activities for knowledge sharing (e.g. through the community of practice and social networks), and for knowledge retention (e.g. through experts, social relationships, and technology). The lower part of Figure 4.5 summarises the characteristics of the three knowledge processes as they have been described in the sections on knowledge processes. The findings indicated that knowledge processes and their interrelation remained unchanged during certain periods in the integration of B2B e-commerce.

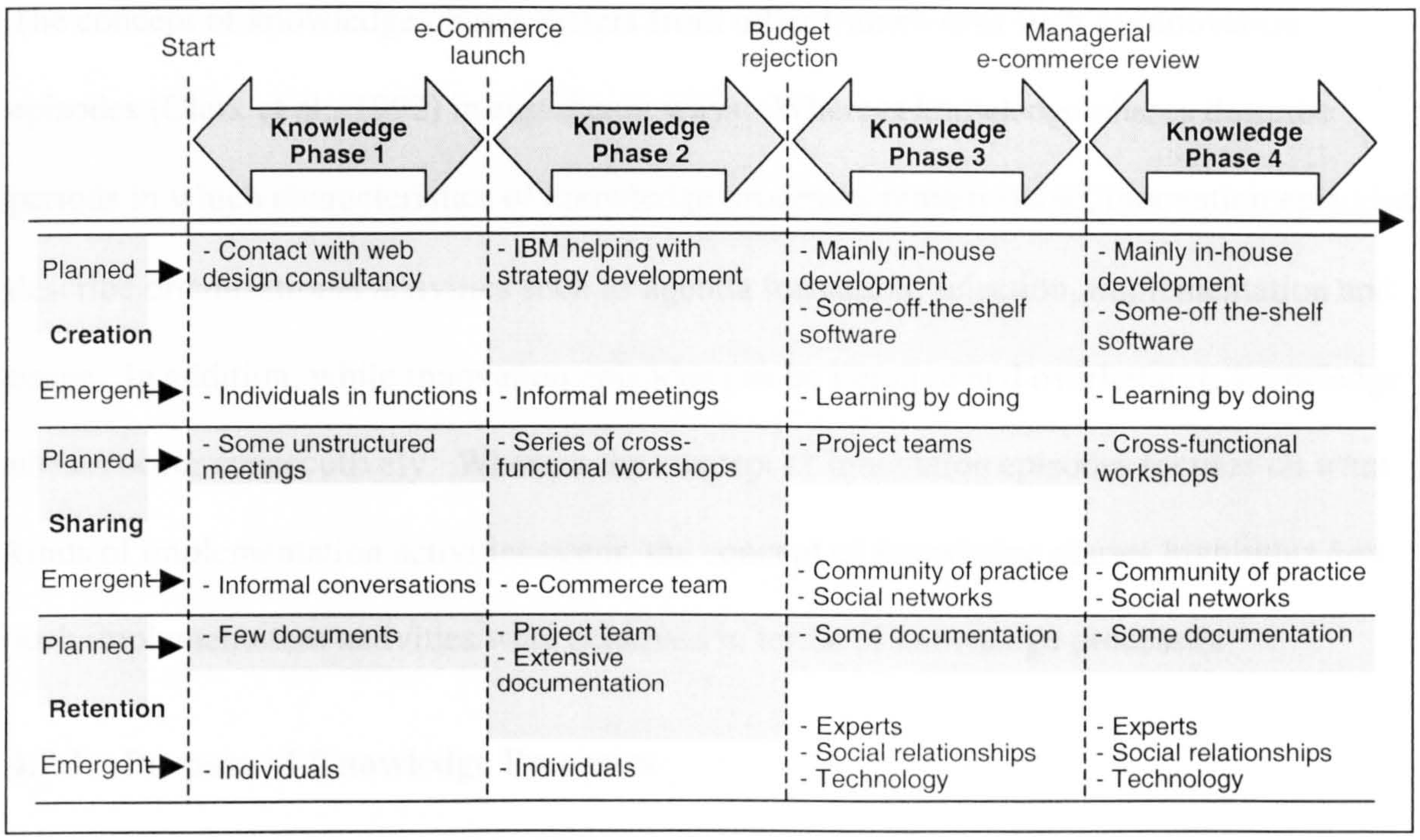


Figure 4.5: The Concept of Knowledge Phases

The stable interrelation between knowledge processes appeared to be disrupted through organisational events that organisational members perceived to be important.

Organisational members frequently mentioned three events that changed the activities and dynamic of the integration of B2B e-commerce. First, the official launch of the e-commerce initiative marked a significant change to the characteristics of knowledge processes, as they became more planned and relied strongly on formal activities such as workshops etc. The e-commerce initiative "changed from being people's love pet to a real project" (IS manager). Second, the rejection of the e-commerce budget marked a further event, which was perceived as changing the trajectory of the innovation process. Without the funding for a strategic project, ComCo "had to change the approach completely and see what we could do without money" (Robert Miles). Third, the managerial intervention after the second rejection of the e-commerce budget changed the status of the initiative from being limited to the people directly involved in the e-commerce projects to being an innovation that would affect the whole organisation.

The concept of knowledge phases differs from other frameworks such as innovation episodes (Clark et al., 1992) in significant ways. Whereas knowledge phases describe periods in which characteristics of knowledge processes remain stable, innovation episodes describe organisational activities such as agenda formation, selection, implementation and usage. In addition, while innovation episodes can be iterative and overlapping, knowledge phases occur consecutively. Whereas the concept of innovation episodes focuses on *what* kinds of implementation activities occur, the concept of knowledge phases highlights *how* such implementation activities were achieved in terms of knowledge processes.

4.7.3 Purpose of Knowledge Processes

The findings suggest that there were identifiable phases in which knowledge creation, sharing, and retention remained relatively unchanged. The empirical data suggests that there was a series of four knowledge phases during the integration of B2B e-commerce at ComCo. The knowledge processes in each of the knowledge phases appeared to serve a specific function in the innovation process, as depicted in Figure 4.6. The knowledge phase of inception describes a period of time in which knowledge processes supported the initial contact of individuals in the organisation with the concept of B2B e-commerce, prior to the start of a formal initiative. Knowledge processes were emergent and based on the initiative of individuals who were personally interested in the topic of e-commerce.

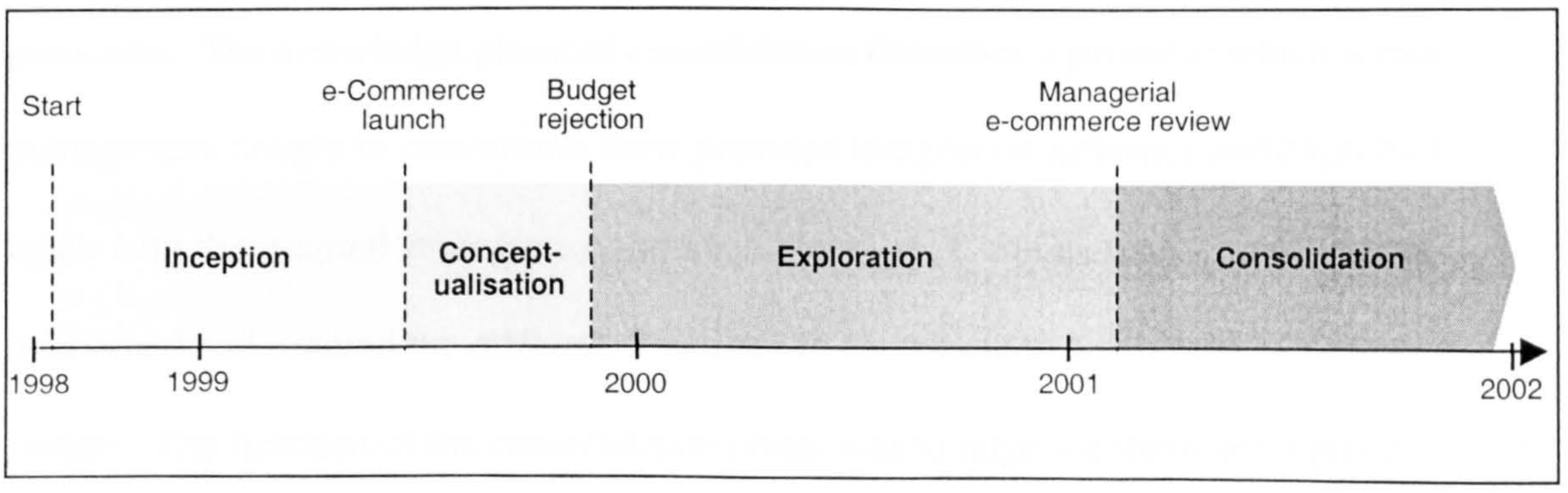


Figure 4.6: Knowledge Phases in the Integration of B2B e-Commerce at ComCo

The characteristics of knowledge processes changed significantly once the integration of B2B e-commerce was launched as a formal initiative at ComCo. The knowledge phase of

conceptualisation describes a period of time in which ComCo drew systematically on external and internal knowledge in order to develop a strategy for the integration of B2B e-commerce at ComCo. External knowledge was brought in by the involvement of IBM Global Consulting, a strategy and technology consultant. Different functions were involved in the specification of technical and business requirements in order to draw on internal knowledge.

The rejection of the project budget at the end of 1999 triggered a further change in the characteristics of knowledge processes. As there were no resources for B2B e-commerce projects, there was no official project. However, middle managers continued with the integration on a small scale by diverting resources from other, non e-commerce related projects. Although senior management tolerated this activity, knowledge processes tended to be emergent. The direction of the innovation was determined by chances and opportunities rather than by managerial business plans. The function of the exploration phase was to give the innovation process the flexibility better to match the e-commerce application with the organisational context, by utilising existing organisational relationships and processes to facilitate the progress of the innovation process.

At the beginning of 2002, senior management took a proactive role in supporting the so far low-profile B2B e-commerce roll out which changed the characteristics of the knowledge processes. The knowledge phase of consolidation describes a period in which senior management sought to consolidate their previous integration activities and align them again with the original strategic e-commerce plans. At ComCo, senior management intervened and ordered the different functions to contribute to a common e-commerce budget. The function of the consolidation phase was to align the innovation process again with the expectations senior management at ComCo had, and to demonstrate that senior management fully supported the integration of B2B e-commerce.

4.8 Manageability of Knowledge in IT-based Innovations

This section provides a thematic account of the manageability of knowledge during the integration of B2B e-commerce, which appeared on two levels. On a knowledge process level, knowledge was managed through a mix of planned and emergent activities. On an IT-based innovation level, there were phases of control and drift that had implications for the management of knowledge. In addition, power and politics influenced management during the integration of B2B e-commerce.

4.8.1 Management Through a Mix of Planned and Emergent Activities

Knowledge processes were managed through a mix of planned and emergent activities (Alvesson and Kärreman, 2001). Figure 4.7 pulls together the findings of each knowledge process. The description of the three knowledge processes has shown that knowledge phases tended to rely more on either planned or emergent activities, which is illustrated by the height of the grey and white bars in Figure 4.7. The height of the bar is not an absolute but a relative measure to indicate to what extent planned or emergent activities appeared to be more dominant.

	Start	e-Commerce launch	Budget rejection	Managerial e-commerce review
Creation				
Planned →	- Contact with web design consultancy	- IBM helping with strategy development	- Mainly in-house development - Some off-the-shelf software	- Mainly in-house development - Some off-the-shelf software
Emergent →	- Individuals in functions	- Informal meetings	- Learning by doing	- Learning by doing
Sharing				
Planned →	- Some unstructured meetings	- Series of cross-functional workshops	- Project teams	- Cross-functional workshops
Emergent →	- Informal conversations	- e-Commerce team	- Community of practice - Social networks	- Community of practice - Social networks
Retention				
Planned →	- Few documents	- Project team - Extensive documentation	- Some documentation	- Some documentation
Emergent →	- Individuals	- Individuals	- Experts - Social relationships - Technology	- Experts - Social relationships - Technology

Figure 4.7: Planned and Emergent Activities During the Integration of B2B e-Commerce

Planned activities were part of e-commerce project management rather than conscious interventions to manage knowledge. At no time during the integration of B2B e-commerce was there a deliberate effort explicitly to manage knowledge. As Robert Miles said "our job is to get the technology working and not to manage knowledge. What has knowledge to do with it anyway?" Planned activities could be both an effective and an ineffective means for facilitating knowledge processes. Planned activities during the conceptualisation phase strongly facilitated knowledge creation and sharing. This was achieved through the cross-functional workshops and the commitment of the participants to driving the initiative forward. In contrast, although the stronger management support during the consolidation phase introduced a greater reliance on planned activities, knowledge sharing continued to occur largely in the community of practice and social networks.

Emergent activities occurred as part of the ongoing social interactions and improvisations of organisational members during the integration of B2B e-commerce (Nidumolu et al., 2001). John Payne said, " the implementation of e-business has been a complete roller-coaster experience. Each day there were different challenges and lots of fire fighting". Similarly to planned activities, emergent activities could be both an effective and an ineffective means for facilitating knowledge processes. For example, knowledge sharing during the exploration phase was dominated by emergent activities. Emergent activities were the result of interaction between members of the community of practice and of internal social networks. However, while knowledge sharing was strongest within the community of practice and social networks, there were virtually no other mechanisms for knowledge sharing as organisational members "were either a part of it or didn't know at all what was going on" (purchasing manager).

Planned and emergent activities were interwoven in two ways. First, although each knowledge process was dominated by either planned or emergent activity as depicted in

Figure 4.7, both types of activity always occurred in the same knowledge phase. For example, knowledge sharing during the exploration phase was dominated by emergent activities such as informal meetings and conversations. Yet there were also, to a lesser degree, planned activities such as formal meetings and presentations. Equally, while knowledge creation was dominated by planned activities since the conceptualisation phase, there were also emergent activities such as learning by doing which derived out of the day-to-day activities of organisational members.

Second, while planned activities showed elements of drift, emergent activities showed elements of control. For example, knowledge creation during the exploration phase was dominated by planned activities such as formal selection of software and the use of IS development methodology. Still, even within these planned activities there was the flexibility to react to necessary changes. Although the IS development methodology set strong guidelines for how to develop B2B e-commerce applications, activities such as altering the requirement analysis allowed the integration of B2B e-commerce to drift from initially defined objectives. Furthermore, emergent activities included elements of control. For example, although knowledge sharing relied on emergent activities during the exploration phase, activities neither appeared randomly nor were left to chance. There was a planned element in the way the community of practice shared knowledge, in so far as knowledge sharing was purposefully related to keeping the e-commerce initiative alive and developing the semi-strategic projects.

4.8.2 Control and Drift

The empirical data seem to suggest that there were phases during the integration of B2B e-commerce in which knowledge processes served a particular purpose, e.g. inception, conceptualisation, exploration, and consolidation. The emphasis on planned and emergent activities in each knowledge phase seems to suggest that knowledge phases can be associated with management as control and with management as drift (Ciborra et al.,

2000). The conceptualisation and consolidation phases appear to be linked to management as control, since they saw strong involvement and support of senior management at ComCo. During the conceptualisation phase, all three knowledge processes were dominated by planned activities. In the consolidation phase, knowledge creation and sharing were mainly based on planned activities, whereas knowledge retention relied on emergent activities. The focus lay on orderly strategic planning during the conceptualisation phase and on the measurement and control of resources during the consolidation phase.

In comparison, the knowledge phases of inception and exploration can be associated with management as drift, because of the general absence of senior management involvement. Instead, the integration of B2B e-commerce relied on improvisation and day-to-day planning. In the inception phase, all three knowledge processes were dominated by emergent activities. In the exploration phase, knowledge sharing and retention were mainly based on emergent activities, whereas knowledge creation relied on planned activities.

Besides the knowledge phases of inception and conceptualisation which saw an emphasis on either planned or emergent activities for all three knowledge processes, the exploration and consolidation phase showed a mix of planned and emergent activities. For example, while the exploration phase can be understood as management as drift due to limited senior management involvement and the high degree of improvisation, knowledge creation still relied on planned activities. This indicates that even periods of drift can have elements of control in terms of knowledge processes. Similarly, despite the reliance on planned activities for knowledge creation and sharing, knowledge retention was dominated by emergent activities. This would suggest that periods of control have elements of drift.

4.8.3 Influence of Power and Politics

This section looks briefly at the issue of power and politics in as far as it affected the management of knowledge during the integration of B2B e-commerce at ComCo. For example, as mentioned earlier there was a "them and us" culture with regards to the relationship between ComCo and WorldCo. The continuation of the e-commerce projects even after the rejection of the e-commerce budget for 2000 and 2001 can be seen as deliberate attempt by ComCo to show its independence. Even though the scope of the integration was limited, the e-commerce project symbolised and reinforced the already existing notion that WorldCo was ignorant of the needs of a manufacturing company, and ComCo knew best what to do in terms of integrating new technology.

Tensions were not only apparent in the relationship with the parent company but also in the relationship with other brands such as Fendt, a German sister company. Although there were multiple opportunities to approach projects collaboratively, there was no cooperation between the two companies. The lack of cooperation was justified on the grounds that both had different legacy systems and different markets to serve. For example, while a ComCo IS manager described Fendt's legacy systems "as completely different because they go down the SAP route", a Fendt IS manager described ComCo's legacy systems as "lots of rubbish". Also, from a power perspective, both companies, which had only recently been acquired by the parent company WorldCo, struggled to keep their independence and were hostile towards any efforts that would integrate applications as "everyone did whatever they wanted in Europe" (Fendt IS manager). Consequently, ComCo and Fendt developed dealer applications with the same functionality, completely independently of each other.

Although it would have been expected that external partners such as dealers and suppliers would have been involved at some stage to specify the requirements of B2B e-commerce applications, ComCo did not consult them until the applications were tested as pilot

projects. At that point, both suppliers and dealers were presented with nearly finished applications and the changes that could be made to the applications were already very limited. The reasons commonly given for not having external stakeholders involved in the requirement analysis was that ComCo did not want to raise expectations and then not be able to fulfil them. It appeared that such an incident had happened before, which made ComCo reluctant to invite dealers to participate.

There was also a power struggle between departments within ComCo. For example, when the marketing department decided to use a website for a product launch, they avoided the MIS department because they would have applied their IS development methodology, which they said would have taken too long. Martin Evans compared the MIS methodology with a tanker that moves slowly but surely. He was convinced, however, that some e-commerce applications need a "speed boat approach" that makes things happen very quickly. The MIS department criticised the marketing department for producing an inferior technical application that could not been linked into the existing systems. It could be argued that the MIS department had a particular working style, e.g. reliance of traditional methodology, and saw itself responsible for all IS related projects in ComCo. Other departments were dissatisfied with the time it took to implement applications and once they looked for alternatives, the status quo of power relations was disrupted.

4.9 Integration of B2B e-Commerce – A Summary

Figure 4.8 summarises the empirical findings regarding the iterative and overlapping innovation episodes of agenda formation, selection, implementation and usage (upper part of the figure), and the processes of knowledge creation, sharing and retention (lower part of the figure). In addition, it delineates the findings of four knowledge phases in the integration of B2B e-commerce at ComCo. In terms of innovation episodes, the integration of B2B e-commerce can be traced back to June 1998 when the marketing department raised awareness of e-commerce by implementing an ComCo website for the

launch of a new tractor. In May 1999, ComCo officially launched its e-commerce initiative by developing an organisation-wide strategy and preparing a budget proposal for 50 projects to be approved by its parent company, WorldCo. Despite the rejection of the e-commerce budget, middle managers at ComCo displayed a high degree of entrepreneurial behaviour in order to keep the e-commerce initiative alive, by pulling together resources from other projects and developing some applications on a small scale. After the rejection of a revised e-commerce budget at the end of 2000, senior management at ComCo intervened by forcing different functions to financially support the integration of e-commerce. The case study demonstrates how knowledge creation, sharing and retention was facilitated by a community of practice and by social networks in the absence of strong senior managerial support and official funding.

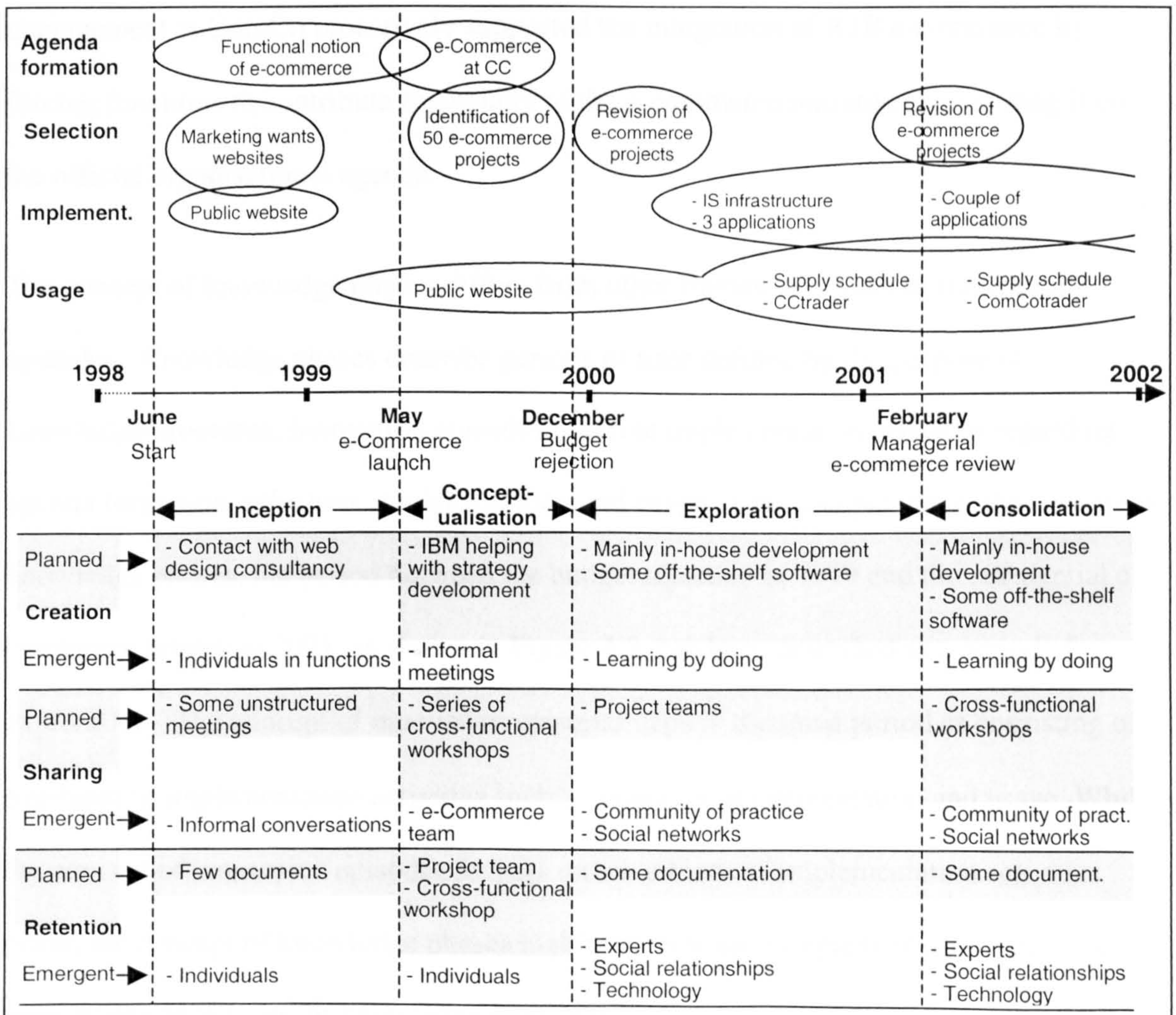


Figure 4.8: Summary of the Integration of B2B e-Commerce at ComCo

The empirical findings suggest that there were phases in which the characteristics of all three knowledge processes such as the reliance on planned and emergent activities remained unchanged. This research identified four knowledge phases in the case of ComCo. The first knowledge phase of inception describes a period of time in which emergent activities supported the initial contact of individuals in the organisation with the concept of B2B e-commerce, prior to the start of the formal e-commerce project. The conceptualisation phase depicted a period in which planned activities, such as the establishment of a formal project structure, were put in place to develop an e-commerce strategy. The exploration phase was a period in which middle managers relied on an emergent, flexible and entrepreneurial approach to explore the applicability of B2B e-commerce for ComCo. The consolidation phase describes a period of time in which senior management at ComCo proactively supported the integration of B2B e-commerce by forcing functions to contribute financially to the e-commerce initiative, and putting it on the official organisational agenda.

The concept of knowledge phases differs from other frameworks such as innovation episodes. Knowledge phases describe periods of time defined by the purpose of knowledge processes, innovation episodes describe implementation activities regarding agenda formation, selection, implementation and usage. For example, using the concept of knowledge phases, the period between the budget rejection in 1999 and the managerial e-commerce review in 2001, as shown in Figure 4.8, has been described as a period of exploration. The concept of innovation episodes depicts the same period as consisting of overlapping implementation activities such as selection, implementation and usage. While the concept of innovation episodes focuses on *what* kinds of implementation activities occur, the concept of knowledge phases highlights *how* such implementation activities were achieved in terms of knowledge processes.

Concerning the management of knowledge in IT-based innovations, the case study produced three significant findings. First, knowledge was managed through a mix of planned and emergent activities (Alvesson and Kärreman, 2001), as depicted in the lower part of Figure 4.8. Planned activities were part of the B2B e-commerce management rather than conscious interventions to manage knowledge. Emergent activities occurred as part of the ongoing social interactions of organisational members. Planned and emergent activities occurred simultaneously and were mutually constitutive. Second, both management as control and management as drift (Ciborra et al., 2000) occurred during the integration of B2B e-commerce. While the inception and exploration phases could be associated with management as drift, the conceptualisation and consolidation phases were more strongly related to management as control. Power and politics (Knight and Murray, 1992) affected the management of the integration of B2B e-commerce at ComCo, in that it prohibited cooperation externally, e.g. with WorldCo, Fendt and supply chain members, and internally, e.g. between different functions.

5. AutoCo Case Study

5.1 Introduction

This chapter presents a chronological description and a thematic account of the integration of B2B e-commerce at AutoCo with a focus on the Online Quoting (OLQ) project. The research focuses on this project because it was the most advanced application that had already been implemented and deployed at the time of the research, whereas other projects were still at a conceptual stage. Figure 5.1 depicts the structure of this chapter. After this introduction, the innovation process is described in detail by introducing the organisational context and providing a chronological description of the integration of B2B e-commerce at AutoCo. Then, a thematic account of the innovation is given. First the processes of knowledge creation, sharing, and retention are summarised and the findings regarding the framework are outlined. This is followed by a description of issues regarding the manageability of knowledge during the integration of B2B e-commerce. This chapter concludes with a summary of the main issues found at AutoCo.

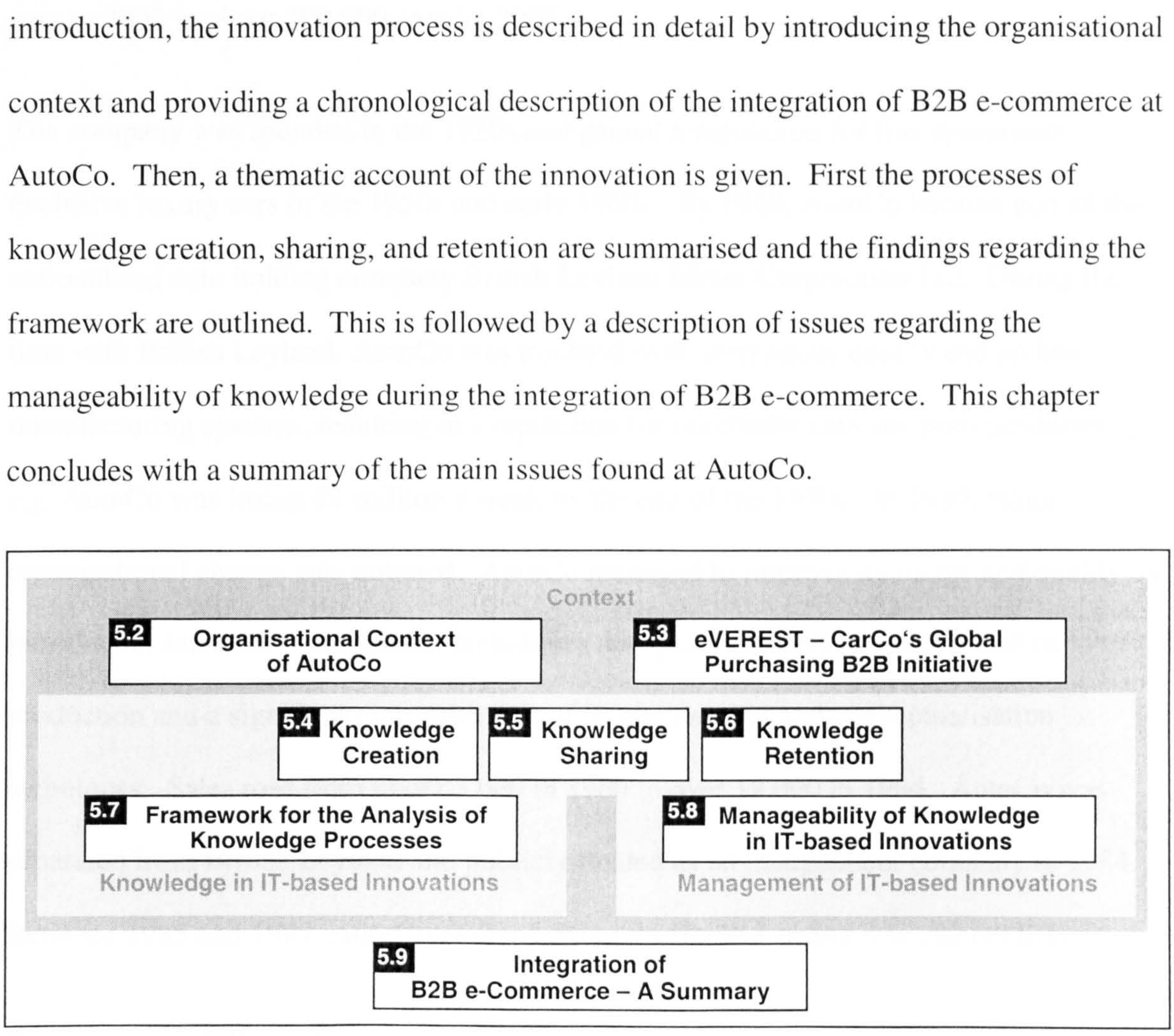


Figure 5.1: Structure of the AutoCo Case Study Chapter

5.2 Organisational Context of AutoCo

In order to understand many of the underlying issues during the integration of OLQ, it is important to illustrate the organisational context. This is done by presenting a brief history

of AutoCo, elaborating on its values and culture and describing the relationship between AutoCo and CarCo.

5.2.1 History of AutoCo

AutoCo is one of the world leaders in the conceptualisation and manufacture of premium cars, with headquarters in the UK. AutoCo set an all-time record in 2000 with worldwide sales of over 90,000 cars with around 80 per cent of sales abroad, mainly in the US and Continental Europe. AutoCo produces five different model ranges and it has different sites in the UK. AutoCo has ambitious plans to increase the production number from 90,000 cars in 2000 to about 200,000 cars by 2005.

The company was founded in the 1920s and gained a reputation for fine sports and exclusive luxury cars in the 1950s and early 1960s. By 1968, AutoCo became part of the nationalised auto holding company British Leyland Motor Corporation Ltd. During the time with British Leyland, AutoCo was troubled with horrendous quality and archaic manufacturing systems, resulting in a reputation for unreliable cars and poor productivity, e.g. AutoCo was losing £1 million a week by the end of the 1970s. In 1980, major organisational change was initiated. AutoCo managed to improve its image and quality by introducing Japanese management techniques and quality circles, automation of its production and a significant improvement of its engineering and conceptualisation techniques. Sales rose from under 3,000 in 1980 to over 18,000 in 1984. AutoCo was separated from British Leyland and publicly floated as an independent company in 1984. Between 1985 and 1987, AutoCo enjoyed rising profits and strong investor confidence.

Due to a weak dollar and a drop in sales in the US, AutoCo was forced to cut capital spending and delay the introduction of new models. The Board of Directors recognised the potential value of collaboration with a leading car manufacturer. In 1989, CarCo bought AutoCo for US$2.6 billion and it has become part of CarCo's Premier Automotive Group

(PAG) together with other brands. However, it was agreed to recognise the integrity of the AutoCo company and stipulated that AutoCo was to remain a separate legal entity with a self-sustaining capital structure and its own Board of Directors. Since then, CarCo has invested as much as US$6 billion to overhaul factories in the UK by installing a modern assembly line and expanding the plant. As a result, the productivity has quadrupled and the quality of cars has risen to the top in the US quality ratings.

5.2.2 AutoCo Values and Culture

People working at AutoCo took great pride in the product and strongly identified with the company. There was also a strong sense of heritage and tradition among AutoCo employees. As one employee put it "I worked at many places but only here you are part of something more special. We are talking about AutoCo here". In addition, work places were decorated with AutoCo branded items such as glossy posters, miniature models, table calendars. On Fridays, the casual dress day at AutoCo, many people wore shirts and jackets with the AutoCo logo embroidered. The reason for this might be that AutoCo symbolises sophisticated British engineering and incorporates positive attributes such as luxury, desirability and refined performance. The strong identification with the product and the brand has been recognised by David Wright who said "We [CarCo] helped them [AutoCo] on quality, we instilled sound business principles. But we also learned a great deal...about how you connect emotionally with the marketplace, how you get a team spirit with every person in the company feeling a passion about the brand" (Owen, 2000, p.76).

The combination of pride and the sense of heritage resulted in a strong identification with AutoCo. Employees who had been with AutoCo in the 1980s before CarCo took over had a strong sense of achievement after turning the ailing AutoCo around and making it profitable again. There was a narrative that AutoCo would have been "strong enough to survive as an independent manufacturer" (purchasing manager). CarCo's role was being perceived as a hostile take-over although over 90 per cent of shareholders approved the

Board's recommendation to accept CarCo's offer. AutoCo's independence was emphasised by having its own Board of Directors, remaining a separate legal entity rather than a CarCo business unit, keeping the CarCo and AutoCo brand apart in marketing, and having their own dealer network. In general, employees felt strongly about belonging to AutoCo and not CarCo. Virtually anything that came from CarCo, e.g. initiatives, was seen to be highly suspicious and as an attempt to "interfere with AutoCo's way of doing things" (senior manager).

Quality in manufacturing and car reliability was a major issue at AutoCo. Particularly with the introduction of Japanese TQM management principles in the 1980s and the refocusing on quality after the acquisition of CarCo, engineering, purchasing and manufacturing acquired a strong sense of quality. For example, AutoCo took over a former CarCo plant. The CarCo plant had a weak quality record and the overall morale was low. In addition, there was a strong cultural division between management and workers. AutoCo managed to bring the plant up to AutoCo standards by improving production quality, creating centres of excellence for continuous improvement and initiate cultural change. Equally, quality was a major talking point among buyers when it came to selecting suppliers. In many cases, higher prices for commodities were accepted if the buyer was convinced that these commodities were quality sensitive.

5.2.3 CarCo and its Relationship with AutoCo

CarCo is the one of the largest automotive manufacturing business in the world, with sales of US$162.4 billion in 2001. While CarCo posted a US$5.4 billion profit in 2000, it made a loss of US$5.5 billion in 2001 due to a cooling down of the world economy and multibillion-dollar recalls. In addition, CarCo had lost a quarter of its market share in Europe, falling from nearly 12 per cent to less than 9 per cent between 1995 and 2000. In order to improve profitability, CarCo set itself the aim to cut overall costs in Europe by

US$1 billion. Measures included cost reduction in the procurement area and the expansion of AutoCo car production, which traditionally operated with a high profit margin.

Throughout the interviews and during participant observations, it became obvious that people at AutoCo were hostile towards CarCo. Across all the remarks made regarding the relationship between CarCo and AutoCo, there were a number of recurring issues:

- **Them and us culture**: People perceived AutoCo to be largely an independent company with its own headquarters in the UK, and its own engineering site and production facilities. People took great pride in the fact that AutoCo set an all-time sales record for 2000 despite the overall industry downturn, in contrast to CarCo, which was suffering severe economic losses.

- **Cost vs. quality**: One major difference was that CarCo was, by tradition, a mass-market vehicle manufacturer whereas AutoCo had always been a niche market player aiming at the premium automotive segment. While the main focus of CarCo initiatives was to "cut cost through streamlining business processes and optimising production" (purchasing manager), the main emphasis at AutoCo was "to assure a high level of quality" (engineer). AutoCo was often in a difficult position to maintain quality levels and, at the same time, achieve cost savings.

- **Outdo CarCo**: At AutoCo there was an implicit strive to outdo CarCo in corporate initiatives to prove and reinforce AutoCo as an independent entity that can excel any other company. Particularly CarCo UK was perceived to interfere in AutoCo's activities by trying to "highjack corporate initiatives and make its own mark on it" (purchasing manager).

5.3 eVEREST – CarCo's Global Purchasing B2B Initiative

This section provides a chronological description of the integration of B2B e-commerce between 1999 and the end of 2001 at AutoCo.

5.3.1 "e-Business is THE business" – CarCo's Top Management Vision

In autumn 1999, senior management at CarCo was faced with a number of problems that triggered the need to transform CarCo's supply chain. First, CarCo's legacy systems were based on a 25 year old technology that caused an ever greater number of operating problems for users and required a high level of maintenance. Second, on an operational level, there was a strong need to integrate global purchasing across business units and newly acquired brands, the automation of standard transactions as well as the avoidance of duplicate systems and data sources. Third, CarCo needed to integrate the extended supply chain to tackle problems such as lack of information, inefficient material forecasting, unstable production schedules and the lack of real-time consumer demand to drive material requirements. Fourth, there was fierce competition with competitors who were also undertaking global e-procurement initiatives.

At that stage, top management at board level in the US developed the vision of CarCo being a "new economy" company that embraces new Internet-based technology to transform core business processes and introduce e-commerce capabilities throughout the supply chain. David Wright, CEO of CarCo, coined the phrase "eBusiness is THE business" which was perceived as a powerful statement to illustrate CarCo's strategic direction internally. Officially, CarCo's main objectives for its e-commerce vision were to be perceived as being at the forefront of the commercial use of the Internet and to improve productivity. David Wright described the phenomenon as running a campaign to portray his company as being in the vanguard of the car industry's attempts to embrace the Internet (The Economist, Nov 6, 1999). However, internally the main reason was seen to be costs. "CarCo had three objectives: Costs, costs, costs" (Peter Watson).

Right from the start, the e-commerce initiative was developed with and concurred in by top management such as David Wright, CEO, Carlos Mena, Global President Purchasing, and Frank Taylor, Head of AutoCo Purchasing. Through communications to CarCo employees, it was made clear that e-commerce was a priority for top management and that it would receive the necessary financial resources and backing. Whereas top management gave out the general ideas, it was up to the heads of the different brands to "get the job done" (Peter Watson) by developing an operational e-commerce strategy.

5.3.2 Defining the Corporate B2B e-Commerce Strategy – The eVEREST Initiative

In early 2000, the top management in the US gave the different brands the task to define a corporate e-commerce strategy. This was done by creating steering teams in the different brands whose task it was to generate concrete ideas of how to use web-based applications and what kind of cost savings could be achieved with them. These suggestions were then filtered upwards to be discussed in pan-brand workshops.

An external consultancy, Boston Consulting, was used to support and coordinate the interaction between the different brands. They were selected because they had worked with Brand II before on e-commerce related issues and were generally perceived to be the richest source of external knowledge on e-commerce strategy. Consultants worked with steering teams in the different brands to gather relevant information for the e-commerce strategy. For example, they interviewed senior managers in the purchasing department and asked employees to give them an estimate for annual cost savings that could be achieved through the use of e-commerce applications. Then, on a pan-brand level, Boston Consulting brought together function heads of different brands in workshops to discuss the possible ways of applying e-commerce applications for the individual brands, the PAG as well as the whole of CarCo.

The workshops involved intensive, mostly face-to-face meetings to define a corporate e-commerce strategy. Discussions and reaching agreements were found to be particular difficult for two reasons. First, the different brands sought to maintain a high level of autonomy for their operations which was threatened by a company-wide standardisation and harmonisation of systems and processes. Second, brands disagreed on cost being the driver of the e-commerce strategy. Whereas CarCo's main objective was to cut cost at any price, PAG brands such as AutoCo and Brand I saw quality of systems and processes as the most important issue. Their position was that "cost could be cut as long as it would not jeopardise a quality environment, which is particularly important for a luxury car manufacturer" (purchasing manager). The functionality for e-commerce applications would have to be far greater for luxury cars than for more "cheap and cheerful" CarCo cars. "People pay extra money for a AutoCo, so we have to go the extra mile" (Alan Spencer).

The communication during the workshops was mostly informal consisting of emails to coordinate workshops and slides for presentations. The main formal output of the strategy definition was a presentation of about 300 slides that specified the e-commerce strategy for CarCo, the PAG, and functions, suggesting individual projects based on return on investment and time tables for the roll out. There was extensive use of quantitative data to justify the projects. Members of the workshop gave the presentation to CarCo's top management in January 2001 and it was "well received" (Peter Watson) by David Wright and Carlos Mena.

The part of the e-commerce strategy that dealt with B2B e-commerce became known as the eVEREST initiative. The objectives of the eVEREST initiative were to achieve US$1 billion incremental cost savings over 3 years, transform and web-enable purchasing processes and accounts payable, and leverage CarXchange and other marketplaces to achieve lowest possible cost and highest quality from suppliers. The eVEREST initiative

consisted of three groups of projects aiming at providing buyers with relevant information for better sourcing decisions, automating non-core transactions e.g. purchase orders, and creating buyer and supplier portals allowing users to have access to all relevant data in the CarCo systems. From February 2001 onwards, direct and indirect procurement process design working sessions were held. The purpose of the working sessions was to re-engineer business processes with an emphasis on improving current business processes. At the time of the research, the eVEREST initiative was still at an early stage and projects were falling behind schedule due to delays in developing the right software and specifying the applications.

5.3.3 Online Quoting: The Use of B2B Marketplace for Purchasing

The main focus of this research is on the integration of OLQ. Although officially it was only one project within the eVEREST initiative, it was the most advanced one and managed independently from the eVEREST initiative. OLQ was first used by CarCo US in 1999. Due to the substantial cost savings which had been achieved, CarCo invested huge amounts of money into the development of CarMarketplace and later CarXchange which were B2B marketplaces for the automotive industry. By pressing the use of OLQ through their own B2B marketplaces, CarCo thought to benefit from cost savings and, at the same time, from developing and promoting the B2B marketplace. OLQ was considered to be a "golden bullet" (buyer) to cut costs. Early experience at CarCo US suggested that it was a "quick, easy and virtually automatic way to shave off between 10 and 15 per cent on the purchase of production and non-production commodities" (Maria Wilson).

OLQ, which is also known as reverse auctions or e-auctions, describes a web-based purchasing process in which a company puts a part or service out to tender with a guide price, detailed specification and delivery date. OLQ tend to be reverse Dutch Auctions where the buyer specifies the item (reverse) and prices fall during the auction (Dutch). In

order to gurantee the smooth conduct of an OLQ event, it is important to provide detailed information about the product or service as well as to educate suppliers about the use of the auction software. All those interested will then bid online at a defined date and time. Online means that suppliers use the Internet to connect to auction software provided by a B2B marketplace. A B2B marketplace is a website that hosts secure applications allowing buyers and sellers of commodities to interact (Sculley and Woods, 1999; Kaplan and Sawhney, 2000). The bidding is open for all taking part to see and the price is bid down, typically with a number of competitors dropping out along the way. The buyer is not obliged to accept the lowest, or any, of the other bids

CarCo took a top-down approach to roll out the OLQ. Other brands within CarCo were given no influence in selecting software suppliers or specifying the functionality of the software used for conducting OLQ. Since CarCo US took the lead and established the B2B marketplace, there was no scope for subsequent changes in software supplier arrangements and the software specifications. At the same time, the success of the B2B marketplace depended on the fast and extensive deployment of OLQ by the different CarCo brands which did not allow for any delays due to later alterations. Consequently, there was very little IS expertise needed to conduct this project at AutoCo, except giving buyers access to the Internet.

There was top executive support from Carlos Mena, head of worldwide purchasing, who directly reported to David Wright. Objectives and aims of the OLQ project cascaded from CarCo US, to CarCo UK, and then to the individual brands in the PAG. The official project was launched at the European brands in the third quarter of 2000. As with other projects associated with the eVEREST initiative, CarCo US created a "Pan-Brand eBusiness Matrix Organisation" for European purchasing functions. This meant that in all of the European brands, e.g., AutoCo, CarCo UK, Brand I, Brand II and Brand III, projects were conducted simultaneously and coordinated across brands. In the case of OLQ, all of

the brands excluding Brand III participated in the implementation (the purchasing volume of Brand III being too small to be of any relevance).

There were two formal organisational structures created for the integration of the OLQ tool to coordinate the activities across brands. On an operational level, Brand II, AutoCo, Brand I and CarCo UK assigned individuals to oversee the integration. The individuals were Paul Turner for AutoCo, Harry Gibbs for Brand I, Lars Thomasson for Brand II, and Maria Wilson for CarCo. These individuals formed also a pan-brand OLQ project team that was responsible for coordinating pan-brand activities, identifying pan-brand opportunities, sharing lessons learned, and improving OLQ processes. The pan-brand OLQ team was led by Chris Hall of CarCo UK. On a strategic level, there was a pan-brand OLQ committee consisting of purchasing directors of CarCo UK, AutoCo, Brand I, Brand II and OLQ management in the person of Chris Hall. Peter Watson was the representative for AutoCo. The meetings were fortnightly and addressed issues such as status and problems of the integration process.

5.3.4 Integration and Use of Online Quoting at AutoCo

Since CarCo perceived OLQ as a standard instrument, which simply needed to be used by buyers, there was no analysis of the technical and functional requirements at AutoCo. Instead, the integration of OLQ at AutoCo started with the roll out of the application to buyers. This approach had two fundamental consequences for the trajectory of the innovation process. First, no requirements from external stakeholders affected by OLQ such as suppliers and engineers were taken into account. Suppliers were only informed about OLQ when they were invited to bid online. It was the role of the consultants of the B2B marketplace to provide them with general information and make sure that they are technically capable of participating in the OLQ event. Engineers played traditionally an important role in making decisions in supplier selection as they worked together with suppliers during the design and testing stage of a new model development. At no time

were suppliers or engineers informed about the reasons and benefits of using OLQ. Second, neither at AutoCo nor at other brands was it felt that the deployment presented a significant change of business processes. Hence, training was kept to a minimum and usually consisted of presentation and assistance for setting up auctions. The consequence was that most buyers felt that it was just another "flavour of the month" rather than a substantial and important extension of the purchasing tools available.

In July 2000, the head of purchasing department at AutoCo put Peter Watson in charge who, in turn, gave Paul Turner the responsibility for the operational roll out to the AutoCo purchasing department. He had been with AutoCo for over 2 years and worked as a senior systems analyst in the purchasing department, with expertise in defining systems and business processes. In order to familiarise himself with the business process to set up OLQ events and to gain first hand experience, Paul Turner ran three pilot auctions at the end of 2000. He approached three buyers whose commodities were successfully auctioned in the US. Whereas buyers contributed with their expertise in sourcing commodities, Paul Turner's role was to ensure that the OLQ purchasing process was followed. The first OLQ event was conducted by using CarMarketplace, CarCo's B2B marketplace, which was later replaced with CarXchange. The pilot auctions were seen as "an opportunity to learn about OLQ, and the outcomes were of secondary importance".

In December 2000, there was a first presentation on OLQ to the whole of the purchasing department. Paul Turner had the impression that the presentation was not successful in putting the importance of OLQ across. Buyers mentioned that "the presentation was something that you had to sit through". In January and February 2000, Paul Turner gave presentations to individual sections of buyers. A section consists of six or seven buyers with one chief buyer as their manager. All sections attended one presentation and "the main selling point of using OLQ was that buyers could achieve cost savings of between 10 per cent and 20 per cent" (buyer). The reception of the presentation was mixed ranging

from positive to hostile. Many buyers did not agree that those cost savings could be achieved, as suppliers would not operate so inefficiently that there would be such a big profit margin.

In theory, buyers at AutoCo would decide whether OLQ was suitable for the commodities and then, if they were found suitable, set up the OLQ according to a business process, which had been defined by the pan-brand OLQ team. The business process was outlined on an A4 page and gave precise details of how to propose an event, receive approval, register suppliers, and run the event itself. The deployment of OLQ depended largely on the buyer's motivation and detailed knowledge of the commodity. Paul Turner's role was to assist the buyer if there should be any questions regarding the OLQ business process and the use of OLQ from a strategic perspective.

In practice, however, the OLQ business process looked quite different. Buyers who were ultimately using the OLQ tool were fairly resistant and reluctant and to use the application. Paul Turner said that "you need to talk them round into doing it because OLQ is against the way we are working". There were five main areas of concern. First, OLQ went against the traditional way of having long term supplier relationships as OLQ involved re-sourcing commodities on a frequent basis to get the best price. Second, due to the complexity of most of the core-production commodities, buyers felt that these commodities were too difficult to be defined for a OLQ event. Thirdly, there were strong concerns that material bought in an OLQ event did not fulfil the high quality levels AutoCo expects from its suppliers which were crucial for a luxury car maker. Fourthly, it was argued that there were high additional costs associated with purchasing via OLQ such as switching costs and auction fees which would outweigh the cost savings achieved through auctions. Finally, OLQ added to the day to day activities of buyers and was perceived as an extra work load in terms of learning how to use the tool.

Until the end of April 2001, 50 events had been run including non-production commodities (fax machines, CAD file conversion, engine testing facilities) and production commodities (oil filters, dipsticks, sintered parts). Cost savings ranged between 81 per cent (CAD file conversion) to no savings (sintered parts). On average, cost savings would fall between 15 and 20 per cent. However, Peter Watson and Paul Turner felt that OLQ could be applied both more effectively, e.g. for a wider range of commodities, and efficiently, e.g. by improving on the OLQ business process. Both became "increasingly dissatisfied with the work in the pan-brand OLQ project team" as it "held us [AutoCo] back in making OLQ work in the context of a luxury car manufacturer" (Peter Watson). The next section outlines the problems with the cooperation between brands.

5.3.5 Problems with Cooperation Between Brands

Senior management, particularly the OLQ directors meeting, strongly advocated pan-brand OLQ events for their distinctive commercial benefits. In a pan-brand OLQ event the same commodity from different brands is quoted at the same time. For example, CarCo and AutoCo would pool their demand for oil filters and would invite suppliers to bid for the aggregated amount. There were a number of advantages for pan-brand events. First, by pooling demand, the companies would buy higher volumes of the same commodity and hence get better prices. Second, by working together, buyers would pool their knowledge about suppliers and therefore be able to invite more suppliers for the event, which would make the auctioning process more competitive. Third, by combining the demand of different brands, the fixed costs associated with OLQ such as auction fees would occur once rather than for each bidding event.

However, due to the different expectations of and attitudes towards OLQ, the coordination of pan-brand OLQ events was highly limited and full of tensions. Brand II had been very successful in reducing purchasing costs by having strong cooperative relations with suppliers. OLQ was perceived to "hit the suppliers, no loyalty and cost savings at any

price" (Lars Thomasson), which went completely against Brand II's traditional approach. Brand I did not "have the time to pick up OLQ" (Harry Gibbs), as it underwent significant organisational change due to a great urgency to replace existing systems with CarCo systems, until the end of 2001. In addition, buyers complained about the amount of paperwork involved in OLQ and perceived CarXchange to be highly unreliable as it was closed down for one month. CarCo UK held the belief that OLQ needed to be applied aggressively for a wide range of products and services as "basically everything was up for grabs" (Chris Hall). Other brands perceived CarCo UK trying to take a leadership role and promoting the use of OLQ for any commodity. Consequently, coordination in the pan-brand team was fairly poor with team members regularly missing conference calls and only doing the necessary work not to be seen to sabotage cooperation. As a result, AutoCo started pursuing its own approach to implement OLQ.

5.3.6 AutoCo Takes Own Initiative

From about May 2001 onwards, the dissatisfaction with the pan-brand approach and in particular the perceived interference of CarCo UK, made AutoCo explore the issue of OLQ independently. Paul Turner took a "much stronger proactive role in helping buyers to set up OLQ". For example, he identified commodities that appeared to be suitable for OLQ and then approached the relevant buyer to persuade him or her to use OLQ. The persuasion was not based on managerial control but on being on good terms with buyers. Communication tended to be informal and mostly face-to-face. Throughout the OLQ business process, Paul Turner took a hands-on approach to help buyers in specifying the request for quotation and interacting with CarXchange. There was a strong reliance among buyers that Paul Turner virtually set up the OLQ event and even took over some of the transactional work. In summary, Paul Turner was the driving force behind the integration of OLQ at AutoCo. AutoCo management approved of his activities and let him get on

with it. Between May and end of July 2001, AutoCo ran about two events per week. In August, they scaled down the events to consolidate their activities.

Since Paul Turner was involved in all of the events he learned a lot about the strategic and operational deployment of OLQ from each event. In addition, he sought to draw on external expertise to learn more about the use and implications of OLQ. Very important was one CarXchange consultant, Jim Scott, who was frequently on site to work with him. Jim Scott had extensive previous experience as a buyer at Rover and as a consultant on OLQ. His expertise was a valuable source for identifying commodities and tailoring the OLQ business process to the specific needs of AutoCo. Jim Scott and Paul Turner developed a friendly and cooperative working relationship that helped each to learn from the other. In addition, Paul Turner drew on existing academic research as part of his Master degree at Warwick Business School. He was particularly interested in the implications of OLQ on traditional supplier relationships.

AutoCo management was keen to promote the proactive initiative and show leadership with OLQ to CarCo. For example, in many pan-brand events, AutoCo took the initiative to suggest potential events, and AutoCo buyers were responsible for taking the lead for setting up an event. This involved interfacing between the suppliers and CarXchange, making sure that other brands sent out their request for a quotation package, ensuring that all activities ran according to the OLQ business process plan. This was quite remarkable because AutoCo had committed fewer resources to the OLQ project than other brands.

Another example was the writing of an OLQ report authored by Paul Turner and the researcher. The report, with the title "Overcoming the challenges of implementing reverse auctions" summarised the activities of competitors and major first tier suppliers, and detailed the drivers and inhibitors of OLQ deployment. The report was distributed among CarCo senior management to signal AutoCo's process leadership.

5.3.7 Consolidation of Online Quoting Activities at AutoCo

Whereas AutoCo management gave Paul Turner a free hand in being proactive, it took a hands-on approach again in August 2001. The reason for the stronger role of management was related to the change of purchasing director. The new purchasing director, Sue Watts, started in August 2001 and replaced Mike Taylor. Sue Watts was an US American and came from CarCo US. She has been described as "strongly cost driven" (John Miller) resulting in a more "aggressive style in squeezing profit margin out of suppliers" (buyer). She was strongly in favour of using OLQ more extensively at AutoCo. Taking a more hands-on approach involved an increase in managerial control of the use of OLQ, the creation of new organisational positions and the training of a new OLQ expert. These activities were unique to AutoCo and could not be found in any of the other brands.

In September 2001, Paul Turner started compiling an OLQ plan for 2002. To start with, he identified all commodities that were to be bought in 2002 by AutoCo. Then there was a series of nine meetings each lasting about two hours between Sue Watts, Paul Turner, Peter Watson and each of the nine chief buyers. In the meetings they went through each commodity and asked the chief buyers whether the commodity would be auctionable. The motto was "any commodity which can be auctioned should be auctioned. Cover as much as possible with OLQ" (Sue Watts). Sue Watts pressed the buyers to accept that any commodity could be purchased through OLQ. During the meeting, Paul Turner took notes and after the meetings, he identified 100 OLQ events for 2002.

Management created two new organisational positions to enforce the uptake of OLQ among buyers. The task of "operational OLQ co-ordinators" was to ensure that buyers met the different deadlines in the OLQ business process and to supervise whether they had implemented any savings coming from the OLQ event. There were three operational OLQ co-ordinators who covered the positions as part of their jobs as buyers. The operational OLQ co-ordinators participated in a number of training sessions, headed by Paul Turner.

Topics in these sessions were, in general, the definition of their roles and, in particular, for example, bundling of commodities and definition of starting price. The other organisational position was that of an "e-belt". There was one e-belt for each chief buyer and his or her group of buyers. As with the operational OLQ co-ordinator, the position was filled besides the regular job as a buyer. The role of an e-belt involved knowing how to set up OLQ events both with suppliers and the CarXchange software, as well as advising other buyers about OLQ related issues such as identification of commodities.

The intention at AutoCo was to pass Paul Turner's experience of OLQ over to John Miller so that Paul Turner could concentrate on another aspect of CarXchange, collaborative development, by the beginning of 2002. By that time, John Miller would take Paul Turner's place and be the focal point of contact for any OLQ related questions at AutoCo. Formal and informal learning played an important role in how John Miller learned about OLQ. Formally, John Miller worked side by side to Paul Turner so that he could be introduced to the task and the people in the purchasing department. In addition, he attended a couple of workshops organised by CarXchange to learn how to use the OLQ application. John Miller and Paul Turner happened to live in the same house and commute together. OLQ was frequently the topic outside work and John Miller could always ask questions about OLQ when they came to his mind.

Although Sue Watts forced buyers to comply with the plan for 2002, buyers were still very "anti" (John Miller) and fairly reluctant to use OLQ. One reason was that OLQ cut the supplier's margin right at the start of the business relation. However, the buyer's performance was measured on the 5.5 per cent annual savings he or she achieved. If the buyers cut the margin in a big one-off event at the beginning of the suppler relationship, he or she could not achieve the 5.5 per cent savings. A further reason was that OLQ was also perceived to generate an extra workload that buyers were unwilling to take on. Finally, the result of an OLQ event was often an extensive list of prices offered by suppliers according

to different conditions, e.g. including/excluding delivery etc. Many buyers simply suffered from information overload and had difficulties making this data the basis for purchasing decisions. A sign of reluctance to use OLQ was the high number of proposed cancellations of events identified in the OLQ plan for 2002.

The quality of cooperation with the other brands within CarCo started to vary significantly. The relationship between Paul Turner and Harry Gibbs were very good because they got on well personally and both being luxury car manufacturers they faced the same challenges. In addition, they were geographically close, so that face-to-face meetings could be arranged more easily. An example of cooperation was that AutoCo and Brand I consolidated their OLQ plans for 2002 in a number of meetings. Brand II was still very reluctant to apply OLQ and there was no real willingness to participate in OLQ events. There was no cooperation between AutoCo and CarCo UK. Other pan-brand team members saw Chris Hall as lacking in credibility because of his "inferior understanding of OLQ" (Paul Turner).

5.4 Knowledge Creation

This section provides a thematic account of the process of knowledge creation during the integration of B2B e-commerce with a focus on OLQ.

5.4.1 Strategies for Knowledge Creation

In the case of the integration of OLQ at AutoCo, the strategy for knowledge creation showed two interesting features. First, the pan-brand OLQ team did not develop a common strategy to create knowledge as a group. Instead, the different local leaders, predominately CarCo UK and AutoCo, learned largely independently from each other. Evidence for this was the way the different brands used the CarXchange consultant. He worked with the brands in the UK separately. He constantly commuted between AutoCo, CarCo UK and Brand I to talk directly to the person responsible for OLQ. However, there

was no combined group approach where the pan-brand OLQ team would come together and learn about OLQ as a group. Any experience of OLQ by other team members was perceived to be highly subjective and to be unique to the context of the other brand. Therefore, the value it might have for their own brand was discounted. There was "no real effort to learn from each other and to create knowledge as a group" (Lars Thomasson).

The second interesting feature of the strategy for knowledge creation was that it changed during the innovation process from a blackboxing strategy to a version of the prisoner strategy, each of which has distinctive features in terms of source of knowledge (Scarbrough, 1995). Up to the end of 2000, AutoCo adopted a blackboxing strategy to create knowledge. This can be explained with CarCo pushing the deployment of OLQ down the corporate hierarchy to the different brands. The objective was "to quickly roll out the application to reap instant cost savings and to promote CarCo's B2B marketplace" (Chris Hall). Sources of knowledge were mainly the auction software and a business process defining how to use OLQ. The auction software presented an off-the-shelf software package for AutoCo that could not be altered to suit its specific needs, such as reflecting a greater emphasis on quality. Similarly, CarCo had developed a standard business process that defined the individual steps a buyer had to go through in order to set up an OLQ event. However, the main disadvantage of adopting a blackboxing strategy was that neither the software package nor the predefined business processes matched AutoCo's full requirements. A buyer said "the software and the business processes were tailored to CarCo's needs that stressed low cost rather than traditional supplier relationships, total cost and quality". These issues, however, were very important for AutoCo and it was felt that the commodified business process was misaligned with their specific organisational context.

As a reaction to the misalignment, there was a change in the strategy in about May 2001, by focusing more strongly on internal knowledge creation. AutoCo put a great emphasis

on developing the OLQ application in-house by allocating organisational resources such as manpower (Paul Turner) to the project. In addition, events were run for learning purposes even if they only had a marginal financial benefit. AutoCo also sought to draw on external knowledge to explore the topic of OLQ and find new ways to apply it to a greater number of commodities. Parallel to the stronger emphasis on internal development, each of the brands developed their own notion of how OLQ could be used in their organisation. For example, AutoCo rejected a commodity suitability list suggested by CarCo by arguing that each brand would have "specific and individual constraints in deploying the tool" (purchasing manager).

During this phase of the innovation process, the main sources of knowledge were both internal and external expertise. Internally, the purchasing department, particularly the buyers, provide valuable knowledge about the general processes involved in purchasing commodities. Externally, Jim Scott, a CarXchange consultant, provided a lot of guidance and support in setting up auctions. Particularly during the first auctions using CarXchange, his role was to "hold hands" (Paul Turner) and to make sure that all the right information was entered on the CarXchange website to prepare for an auction. However, Jim Scott said that AutoCo would not feel the need to learn from CarXchange consultants, due to their previous experience with AutoXchange. He felt that CarCo in general could do much better if they would draw more heavily on the expertise of the CarXchange consultants. Particular areas of improvement were the identification of suitable commodities, choice of qualified suppliers, and improvement of the purchasing process. Instead, the general emphasis was on learning by doing rather than on drawing on external expertise.

Despite the change of strategy, knowledge creation continued to depend on planned activities. The reason for this appeared to be that there was strong top and senior management influence throughout the integration of OLQ, which generated a greater reliance on formal activities such as workshop and project team meetings. Even after

AutoCo pursued a more independent way to integrate OLQ, in-house development relied on planned activities such as formal interaction with the CarXchange consultant.

5.4.2 Technological Frames

Differences in technological frames (Orlikowski and Gash, 1994, Barrett, 1999) held by groups within and outside AutoCo help to understand the difficulties of knowledge creation based on the slow uptake of OLQ at AutoCo and the lack of cooperation between the pan- brand OLQ team. The OLQ project team at AutoCo represented one group that shared the same technological frame. In terms of technology strategy, they saw OLQ as a tool to achieve substantial cost savings. With regard to the nature of technology, the OLQ project team believed that OLQ "could fundamentally be used for any commodity as long as the OLQ event is set up properly" (Paul Turner). Concerning the technology in use, OLQ was perceived not to present a major challenge or change to normal business processes on a daily basis. Instead, it was seen as "an additional tool besides the currently existing purchasing processes to drive down purchasing costs" (Peter Watson). Although the OLQ team was aware of the buyers' perception that OLQ would challenge traditional supplier relationships and the way of doing business, it was not felt that this should impede the deployment of OLQ at AutoCo.

The vast majority of buyers at AutoCo shared common technological frames that resulted in an attitude of resistance and rejection of OLQ. There were a few individuals who were positive about the use of OLQ, but they only represented a minority in the purchasing department at AutoCo. In terms of the technology strategy, there was broad agreement among buyers that cost was the main driver behind the integration of OLQ. With regard to the nature of the technology, the majority of buyers perceived OLQ not to be suitable in many cases to purchase more complex production commodities. Concerning the technology in use, this meant that the majority of buyers thought that "OLQ does not really affect our job because it is going to fade away quickly". Among the reasons why buyers

resisted OLQ was the fact that auctioning would "substitute personal relationships between us [buyers] and suppliers" with an automated way to identify suppliers with the lowest cost. Buyers argued that "the quality of the relationship with suppliers is often hard to quantify" and may rely on trust and knowing each other through a common history.

Suppliers whose products or services were subjects to OLQ constituted a further social group with distinctive technological frames. The vast majority of suppliers was hostile towards OLQ but could not refuse without losing the business. OLQ was dominantly seen as " a measure to cut costs and squeeze profit margins". In particular, it was perceived to adversely affect traditional relationships between suppliers and AutoCo. As one supplier put it "All the personal relation, which we've built up over years, is replaced with technology you can't talk to". Rather than having a relationship built on trust and cooperation, OLQ would favour market mechanisms and price competition instead.

Each of the brands with which AutoCo was working developed different technological frames. Brand I was preoccupied with organisational changes after CarCo bought it from BMW. OLQ was perceived to be one of the "fringe projects that were of low priority" (Harry Gibbs). Consequently, not many resources were devoted to its integration. Based on very limited experience in using OLQ, it was seen as "just another one of CarCo's initiatives to cut costs in purchasing" (Harry Gibbs). There was no real awareness of how it might be used on a daily basis. However, there was the similar assumption as in AutoCo that OLQ was not suitable for a luxury brand, as it might be for a mass market producer such as CarCo. Harry Gibbs said that "we are sitting in the same boat as AutoCo in that quality is paramount for our brand. Obviously, prices are important but not at any cost".

Brand II saw OLQ as a threat to their traditional purchasing process which was based on long-term and cooperative supplier relationships. OLQ was perceived to be a technology for achieving cost savings that were already achieved through these traditional supplier

relationships and, hence, it was not seen to be useful at all. Lars Thomasson remarked that "CarCo was very frustrated because although they tried very hard to get the lowest prices, it was actually us [Brand II] by working with the suppliers, and not killing them off". It was assumed that the technology would destroy interorganisational cooperation and the cost advantage they already had.

CarCo UK adopted the CarCo US view that OLQ was an easy-to-implement application that delivered substantial cost savings quickly. The sole reasons for its integration were to cut suppliers' margins and have better cost benchmarks. OLQ was understood to be an additional tool for the buyers to achieve their annual cost savings. It was seen to be non-disruptive to the existing process. At CarCo, personal relationships and trust in interorganisational relations played a far less important role than at the other brands. Therefore, any concerns about OLQ were dismissed as "perceived issues" (Maria Wilson) rather than seen as a potential barrier.

5.4.3 New Technology and Interpretive Closure

OLQ at AutoCo possessed the properties of new technology that triggered intense sensemaking processes (Weick, 1990). OLQ presented a high degree of unpredictability to AutoCo. Even after having run OLQ events for more than one year, the deployment of OLQ was still evolving as "we [AutoCo] keep on learning about critical issues such as the effect of OLQ on total cost and traditional supplier relationships" (Peter Watson). The unpredictability was less related to the development of the technology but to its use and the business processes for setting up events. Although OLQ involved only a very limited extent of continuity in terms of linking separate internal functions and external bodies, it nevertheless required a strong focus on the continuity of the OLQ business process. The success of OLQ depended on a "closer integration of subprocesses such as supplier qualification and notification of CarXchange" (John Miller). Here, OLQ was a means to put greater emphasis on continuity of the overall purchasing process. OLQ required a high

degree of abstraction as the technology replaced the traditional interaction between suppliers and buyers. Paul Turner said that "Rather than communicating with suppliers individually over an extended period of time to negotiate prices, OLQ replaced this normally very personal relation with a quick and easy bidding process".

The degree of sensemaking increased during the innovation process before it dropped off after the management reviewed the OLQ activities. Until the end of the strategy workshops, sensemaking at AutoCo was fairly low as activities related to B2B e-commerce occurred outside AutoCo. The degree of sensemaking increased when the eVEREST initiative reached the operational level at AutoCo and OLQ was rolled out to buyers. At this point, both the OLQ project team and buyers were first confronted by the notion of OLQ and how it would affect the traditional purchasing process. However, sensemaking was somehow limited since it was perceived as the "flavour of the month and we [buyers] couldn't be bothered". There was a high degree of sensemaking after AutoCo decided to pursue a more independent roll out and the OLQ project team had been given the freedom to tailor the e-commerce application to the AutoCo context. It was at that point that both project team members and buyers at AutoCo intensively matched the notion of the e-commerce application to AutoCo, once it became clear that AutoCo was fully committed to make buyers use OLQ. Buyers were "forced to deal with the topic of OLQ because the management was breathing down our [buyers'] necks". The intensity decreased after the managerial review as at that point assumptions and expectations about OLQ were clearly defined by the different social groups.

At AutoCo, there were a number of triggers that changed the degree of sensemaking about OLQ. The official roll out presented triggering conditions, which were the high degree of novelty and the management initiative to integrate OLQ in the AutoCo purchasing department. In that period, the OLQ project team, in particular, formed assumptions and expectations about OLQ. A further trigger for sensemaking was the internal initiative to

use OLQ more extensively after AutoCo had become dissatisfied with the pan-brand approach. Peter Watson said "we really had to get our heads around OLQ and tailor it for our use. Obviously, we had to discard a lot of ideas from the pan-brand stuff". The OLQ team approached buyers directly and suggested OLQ events for their commodities. In this period, learning by doing affected the assumptions held by both the buyers and the OLQ project team at AutoCo. The managerial review of OLQ presented an additional trigger for sensemaking when management at AutoCo enforced the use of OLQ and buyers had to argue their case as to why they would not use OLQ.

5.5 Knowledge Sharing

This section provides a thematic account of the process of knowledge sharing during the integration of B2B e-commerce.

5.5.1 Role of Social Communities for Knowledge Sharing

A number of social communities contributed to the innovation process at AutoCo (Wenger and Snyder, 2000). The OLQ project team, consisting of Paul Turner and Peter Watson, worked closely together. Whereas Peter Watson's role was to coordinate and supervise the roll out of OLQ, Paul Turner was responsible for the operational roll out including the shortlisting of commodities, and liaison with buyers and the pan-brand OLQ team. Although there were regular formal meetings to which other people such as buyers were invited, informal face-to-face communication was very important. Informal communication was helped by the fact that Paul Turner's desk was just outside Peter Watson's office so that they would run into each other several times during a day. Communication was also facilitated by the fact that the two of them got on well personally.

The responsibility of the pan-brand OLQ team was to coordinate the integration of OLQ between different brands. Although all the team members were in the same age group (about late 20s) and similar kind of position, the interaction was seriously impeded due to

different opinions about the usefulness and applicability of OLQ. The pan-brand OLQ team communicated in various ways. There were weekly conference calls in which the team members were supposed to report on problems and keep each other updated about latest developments. However, these conference calls were frequently cancelled or team members did not participate. Another means of communication was a small OLQ website on the CarCo intranet with contact information, some presentations, and the OLQ business process. However, team members did not use the resource frequently and some content was out of date. Team members made very limited use of emails and telephone calls to communicate with each other. All in all, the team members did the minimum of interaction to satisfy the demand by senior managers to appear to work together.

The purchasing department at AutoCo presented a formal work group that was the ultimate user of OLQ. Knowledge about OLQ was both distributed among buyers at AutoCo and between buyers across the brands who were responsible for the same commodities. As the purchasing department at AutoCo was an open plan office where all the buyers were located, it was very easy for buyers to talk to each other face-to-face. Informal conversations were facilitated by a friendly atmosphere, which was fostered through social events such as boot racing etc. In contrast, the communication between buyers at different brands was far more formal. There were annual "Global Council Meetings" where buyers responsible for the same commodities got together. On a more regular basis, there were conference calls intended to keep each other up to date about suppliers and prices. Knowledge sharing across brands ranged from being very good to being very poor, depending on the individuals involved in the global councils. Buyers at AutoCo commonly perceived CarCo to take the leading role which was resisted by other brands.

Knowledge sharing excluded social groups who played an important role in the integration of OLQ. There was no official communication to engineers who were influential in selecting suppliers. Engineers would work with suppliers of their choice during the

development of new models. Once engineers were satisfied with suppliers they often exerted pressure on buyers to pick specific suppliers, arguing that only those suppliers could deliver components of the required quality. Engineers had their own social networks to discuss the advantages and disadvantages of OLQ. Equally, there was no official communication to suppliers to explain the purpose and reason for an increased use of OLQ. Instead, suppliers tended to be informed that there would be an OLQ event, and CarXchange dealt with the registration and necessary training issues prior to the event.

5.5.2 Boundary Spanning Individual and Social Networks

Knowledge sharing depended largely on a boundary spanning individual and social network (Tushman and Scanlan, 1981; Hansen, 1999). Paul Turner can be seen as a boundary spanning individual during the integration of B2B e-commerce at AutoCo, who became particularly active to facilitate knowledge sharing after AutoCo pursued a more independent way to roll out OLQ. As outlined above it was important to link social communities such as buyers or OLQ team members who had their own specialised knowledge and technological frames regarding the use of OLQ. Externally, Paul Turner interacted with the CarXchange consultant, academics and practitioners. Such interaction was important to learn more about OLQ and get external ideas for selecting commodities and improving the business process of setting up OLQ events. Internally, he interacted with buyers, which was crucial for bringing the topic of OLQ closer to them. In mediating knowledge sharing, Paul Turner clearly promoted his notion of OLQ as "a useful tool for cutting costs with little impact on traditional supplier relationships". His boundary spanning activities were driven by his ambition to prove to his managers that he would be capable of successfully and independently managing projects.

Social networks within CarCo and AutoCo were an important mechanism to keep people informed about relevant issues and the status of projects both on a strategic and operational level. On a strategic level, Peter Watson found his colleagues in the pan-brand committees

to be the "best networks in terms of knowledge sharing". Networking relied on good personal contacts which had developed over time. On an operational level, social networks in the purchasing department helped Paul Turner to identify the specific problems buyers would have with deploying OLQ, and to promote its use. This was facilitated by the fact that the purchasing department was in an open plan office so that there were no physical barriers to getting in contact with people and talking to them directly. Also the atmosphere was fairly relaxed and not intimidating, which otherwise might restrain people from talking to each other. For example, Paul Turner was well connected within the purchasing department due to previous projects. In addition, he was located in the purchasing department and whenever he needed to discuss any issues, they were discussed immediately, face-to-face, with buyers. Paul Turner said "it's very easy to move around here [in the AutoCo purchasing department]. If I need to know something, I just go to see the buyer rather than phoning or emailing him or her".

5.5.3 Planned Activities for Knowledge Sharing

Throughout the integration of B2B e-commerce, there was a changing emphasis on emergent and planned activities for knowledge sharing. The definition of the e-commerce strategy, the initial roll out of OLQ at AutoCo, and the period after the managerial review were dominated by planned activities. The reliance on planned activities for knowledge sharing reflected the high degree of management intervention and the working style of AutoCo. Planned activities such as workshops, presentations and formal meetings indicated senior management's support for a project. It was also a common procedure to roll out new applications through planned activities such as presentations to users. As users tend to be very busy with their day-to-day job, planned activities were "forceful enough to draw their attention to new topics" (Jim Lawrence). However, the planned activities tended to be accompanied by low degrees of knowledge sharing. In particular, knowledge sharing during the roll out of OLQ at AutoCo was limited as buyers implicitly

resisted the use of OLQ. Therefore, buyers attended presentations and officially conformed to the demands of management, but did not seriously engage in learning about the functionality of OLQ.

After AutoCo pursued a more independent integration of OLQ to match the specific organisational context, emergent activities became dominant. Planned activities were limited to regular conference calls between pan-brand OLQ team members which, at that point, only served to satisfy senior management in pretending to take an integrated pan-brand approach. Knowledge sharing relied on Paul Turner as a boundary spanning individual and his social networks within AutoCo. Emergent activities involved frequent informal face-to-face conversations between Paul Turner and buyers in which he promoted the use of OLQ to those buyers whose commodities appeared to be most suitable for OLQ. In contrast to the formal presentations in which buyers tended to reject categorically the OLQ application, buyers were more open to considering the use of OLQ in informal interaction, as their individual concerns could be addressed.

The use of ICT for knowledge sharing was limited despite the existing sophisticated tools such as an intranet and file sharing facilities. The intranet at CarCo was commonly seen as being "a maze" (Steve Russell) as it was difficult to find specific information on the intranet because it was extensive and the search functions usually did not pick up the pages which users felt to be most relevant. In many cases, users simply did not have the time to explore the intranet more fully because of their work commitments. Also intranet users frequently thought that content was generally of low quality and largely outdated. For example, the homepage for OLQ on the CarCo intranet consisted of three pages. One page was a link to a general presentation about the nature and purpose of OLQ. Another page displayed the business process for setting up an OLQ event. The third page had the contact details of project team members. When Paul Turner showed me the OLQ homepage, he

was surprised that it had been updated four weeks before. In addition, the contact details were either wrong or pointed to people who were not involved in the project.

5.6 Knowledge Retention

This section provides a thematic account of the process of knowledge retention during the integration of B2B e-commerce.

5.6.1 Planned and Emergent Activities for Knowledge Retention

There were periods during the integration of B2B e-commerce when knowledge retention was dominated by either planned or emergent activities. During the strategy workshops and after the managerial e-commerce review at AutoCo, knowledge retention was largely planned. During the strategy workshops, planned activities were mainly achieved through the establishment of a cross-organisational workshop. Knowledge was retained as a result of the participants' interaction with the topic of e-commerce. At that point, any knowledge about e-commerce was limited to the participants of the workshop, who tended to be senior departmental managers from different brands. After the managerial review of e-commerce at AutoCo, there was a managerial effort to establish organisational structures such as OLQ co-ordinators and e-belts to integrate expertise about OLQ into the purchasing department.

Planned activities resulted mainly in knowledge retention schema, social systems, and information (Stein, 1995). During the strategy workshops, schema appeared to be strongly influenced by affiliation to a particular brand. For example, the representative of AutoCo continuously emphasised the importance of quality and reliability over the issue of cost, emphasised by representatives of CarCo UK. In addition, there was great emphasis on producing a written document which would outline the e-commerce strategy. The report, which turned out to be a detailed and lengthy PowerPoint presentation, was perceived to be the encapsulation of the work in the workshops. After the managerial review, planned activities sought to establish social systems in the form of organisational structures to

retain knowledge in the purchasing department. In addition, there was a great emphasis on codification of previous experience and OLQ plans. Documents included, for example, the OLQ report, OLQ events held, and a detailed plan for OLQ in 2002.

Knowledge retention relied on emergent activities before strategy development and between the operational start of OLQ at AutoCo and the managerial e-commerce review. Prior to the involvement of a consultancy to develop an e-commerce strategy, it appeared that a small group of top managers at CarCo US set the agenda for establishing the B2B e-commerce initiative. It was reported that there were no planned activities for knowledge creation and sharing. This would lead to the conclusion that knowledge retention was based on emergent rather than planned activities.

The initial roll out of OLQ in the AutoCo purchasing department was also accompanied by emergent activities which showed a lack of systematic approaches to retain knowledge. One major reason for that was the different technological frames held by various social groups. For example, the pan-brand OLQ team did not retain collective knowledge, as team members strongly disagreed about the applicability of OLQ. Although there were a number of presentations in the purchasing department at AutoCo, buyers had shared schema of the unsuitability of the OLQ tool for their specific commodity. In addition, even the OLQ project team at AutoCo initially had little understanding of issues surrounding OLQ such as supplier relationships and the identification of commodities. As the use of OLQ was perceived to be a top-down project from CarCo, the project team saw the roll out as a job to be done without getting too much involved in it. Consequently, knowledge was retained mostly as individual schema holding assumptions about the OLQ rather than an understanding of how to apply it to the purchasing activity.

After AutoCo pursued a more independent approach to rolling out OLQ in the purchasing department, knowledge about OLQ was retained in one main expert and in social relations.

Paul Turner became an expert on issues on OLQ due to his personal interest in the topic rather than due to planned activities. He learned how to identify commodities, set up OLQ events and configure the CarXchange software. Also, Paul Turner developed social relations that helped him to draw on other people's expertise. For example, the good relationship with the CarXchange consultant made it very easy to draw on specialised knowledge on how to operate the CarXchange software. Also the experience of having worked with the pan-brand team and with buyers provided him with a clear understanding of whom to turn to if he had specific questions. Due to his personal expertise and his relational knowledge, Paul Turner's name became synonymous with OLQ at AutoCo.

5.6.2 Organisational Routines

Retained knowledge in collective routines had significant influence on the dynamic of knowledge processes during the integration of B2B e-commerce. To start with, there were strong organisational procedures in the form of project management that influenced knowledge processes. In terms of project organisation, the establishment of pan-brand teams to coordinate the roll out of new applications across different organisations was a standard procedure. The pan-brand team set the basis for planned activities for knowledge processes such as defined ways of sharing knowledge across organisations. Equally, the roll out of new applications was achieved through the use of a standard project structure at the AutoCo purchasing department. This determined the selection and interaction of team members e.g. expertise and atmosphere in the team. The standard project structure also guided the roll out of OLQ to users. This affected planned activities such as presentations to buyers to inform them about OLQ.

The business process of purchasing commodities also proved to be an important organisational routine in the AutoCo purchasing department. This organisational routine defined both the understanding of supplier relationships and the purchasing process. Buyers had an understanding of supplier relationships that was based on the notion of

mutual benefits and good personal relations with suppliers. The purchasing process involved frequent interactions between buyers and suppliers to negotiate prices and conditions of contracts. The business process of purchasing commodities strongly determined the way buyers would interact with suppliers and acquire commodities.

The integration of OLQ failed to retain knowledge by changing these organisational routines. Despite the problems in the pan-brand OLQ team such as the lack of knowledge creation and sharing, there were no changes to the team in form of, for example, new team members or different ways of interaction. Instead, it appeared that each organisation accepted the inefficiency of the pan-brand team but officially supported the project structure in order not to be seen as sabotaging collaborative work within the CarCo Company. Also, the integration of OLQ failed significantly to change the business process of purchasing commodities. Buyers resisted the use of OLQ because it contradicted the traditional purchasing process. Although OLQ was used due to managerial pressure, it was largely the OLQ project team at AutoCo, which identified commodities and set up OLQ events. It appeared that buyers conformed to management pressure but would stop using it once management attention was focusing on other issues.

5.7 Framework for the Analysis of Knowledge Processes

Building on each of the three knowledge processes, this section provides a thematic account of those findings which can be related to the understanding of knowledge in IT-based innovations as a whole.

5.7.1 Dynamic of Knowledge Processes

Very similar to the ComCo case study, the findings confirm the importance of main characteristics of knowledge processes. First, the processes of knowledge creation, sharing and retention were ongoing and occurred simultaneously throughout the integration of B2B e-commerce. For example, knowledge was created throughout the full duration of the

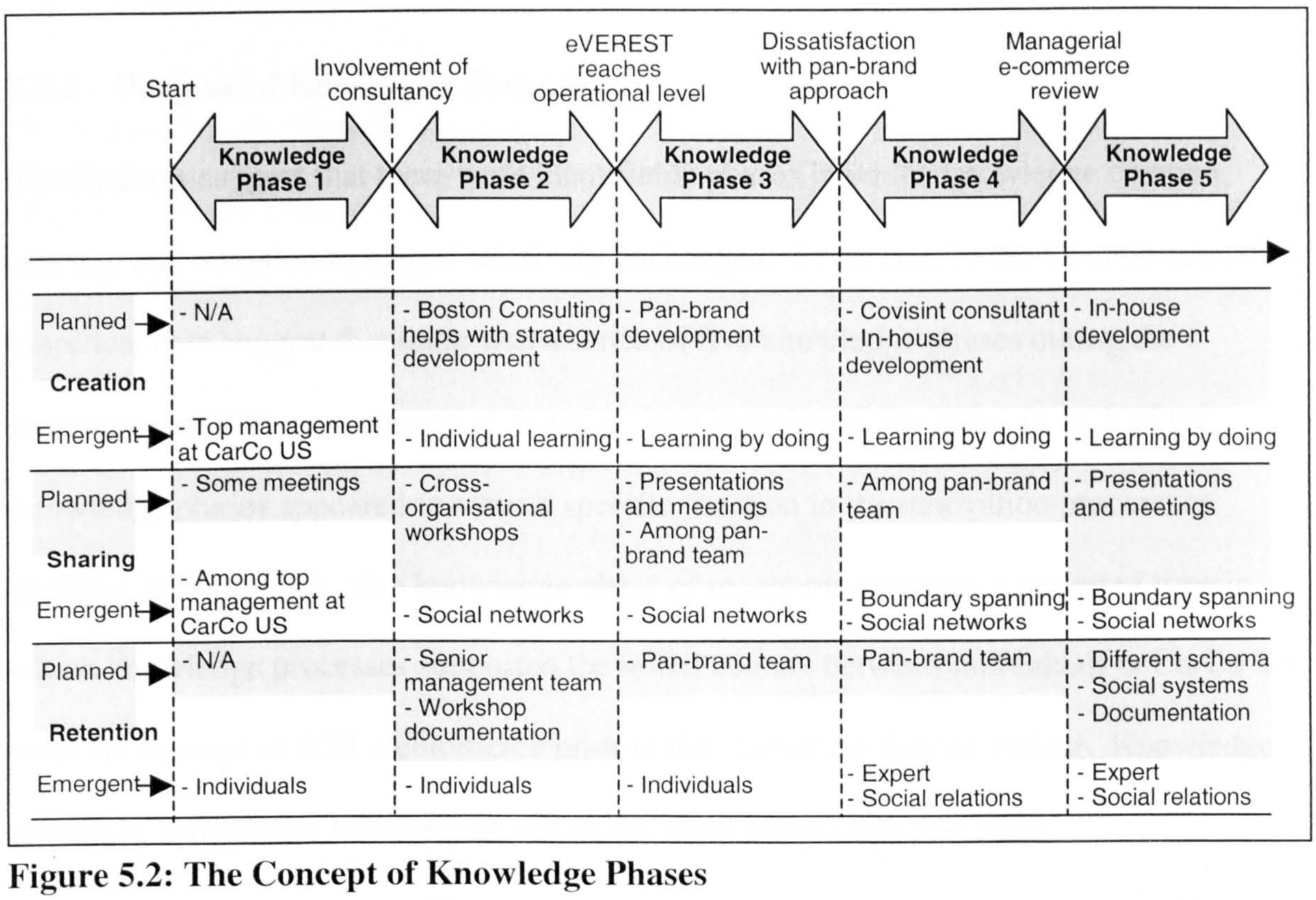
innovation process, first among senior managers and then on an operational level at AutoCo. Knowledge sharing started through formal meetings and presentations and later relied on boundary spanning and social networks. Knowledge was mainly retained by social systems, experts and their social relations. Due to the ongoing and simultaneous nature of knowledge processes, it was not possible to associate knowledge processes to any specific period in the integration of B2B e-commerce.

Second, although knowledge processes were ongoing they varied in intensity during the integration of B2B e-commerce. All three knowledge processes showed low intensity prior to the launch of the official e-commerce initiative, reflecting the emergent activities. Knowledge creation among senior management was most intensive during the workshops to develop the eVEREST initiative. On an operational level, knowledge creation occurred when the project team at AutoCo "got the go-ahead to learn about OLQ ourselves" (Paul Turner). Whereas knowledge sharing among senior manager was most intense during strategy development, it was most intensive among organisational members after AutoCo implemented OLQ more intensively, until the management e-commerce review. Knowledge retention tended to be fairly weak throughout the innovation process.

The third main characteristic is the interrelation between knowledge processes. Knowledge processes appeared not in isolation but in connection with each other. For example, knowledge processes were strongly related after AutoCo took a more proactive role in applying OLQ to its specific context. Knowledge creation relied on drawing on external expertise and learning by doing. Such emergent activities were reflected in the way knowledge was shared within the purchasing department. Also, because project team members felt that they "got a lot more out of OLQ" (Peter Watson), they retained knowledge about this experience. Because knowledge processes were interrelated, the question for this research was to probe further for potential reasons. The next two sections will look at this in more detail.

5.7.2 Knowledge Phases as a Concept to Understand the Interrelation of Knowledge Processes

As in the description of the ComCo case study, the concept of knowledge phases is introduced here as it helps in understanding the interrelation of knowledge processed during the integration of B2B e-commerce. The knowledge phases, as depicted in the upper part of Figure 5.2, can be defined as periods of time during the IT-based innovation in which the relationship between all three knowledge processes are based on stable patterns of organisational activities. The lower part of Figure 5.2 summarises the organisational activities, on which the three knowledge processes are based, as they have been described in the sections about knowledge processes.



Planned → **Creation**	- N/A	- Boston Consulting helps with strategy development	- Pan-brand development	- Covisint consultant - In-house development	- In-house development
Emergent →	- Top management at CarCo US	- Individual learning	- Learning by doing	- Learning by doing	- Learning by doing
Planned → **Sharing**	- Some meetings	- Cross-organisational workshops	- Presentations and meetings - Among pan-brand team	- Among pan-brand team	- Presentations and meetings
Emergent →	- Among top management at CarCo US	- Social networks	- Social networks	- Boundary spanning - Social networks	- Boundary spanning - Social networks
Planned → **Retention**	- N/A	- Senior management team - Workshop documentation	- Pan-brand team	- Pan-brand team	- Different schema - Social systems - Documentation
Emergent →	- Individuals	- Individuals	- Individuals	- Expert - Social relations	- Expert - Social relations

Figure 5.2: The Concept of Knowledge Phases

The stable interrelation between knowledge processes appeared to be disrupted through organisational events that organisational members perceived to be important. Organisational members frequently mentioned four events that changed the activities and dynamic of the integration of B2B e-commerce. First, the official launch of the e-commerce initiative marked a significant change to the characteristics of knowledge

processes as they became more planned and relied strongly on formal activities such as workshops etc. Second, the operational launch of the eVEREST initiative was perceived by the organisational members as "the moment when e-commerce really started and affected normal people" (Steve Russell). The roll out was accompanied by formal "standard tools such as presentations and meetings" (Alan Spencer). Third, the dynamic of knowledge processes changed again after AutoCo became dissatisfied with the pan-brand approach and pursued a roll out that was specifically tailored to the AutoCo context. Paul Turner said "we could then do our thing, the way we wanted it to be". Fourth, the managerial e-commerce review reintroduced a greater emphasis on planned activities which was described as "management moving up a gear" (David Jackson).

5.7.3 Purpose of Knowledge Processes

The findings suggest that there were identifiable phases in which knowledge creation, sharing, and retention remained relatively unchanged. In contrast to the ComCo case, the empirical data suggest that there was a series of five knowledge phases during the integration of B2B e-commerce at AutoCo. The knowledge processes in each of the knowledge phases appeared to serve a specific function in the innovation process, as depicted in Figure 5.3. The knowledge phase of inception describes a period of time in which knowledge processes supported the initial contact between individuals at CarCo US with the concept of B2B e-commerce prior to the start of the formal project. Knowledge processes appeared to be emergent across the three knowledge processes.

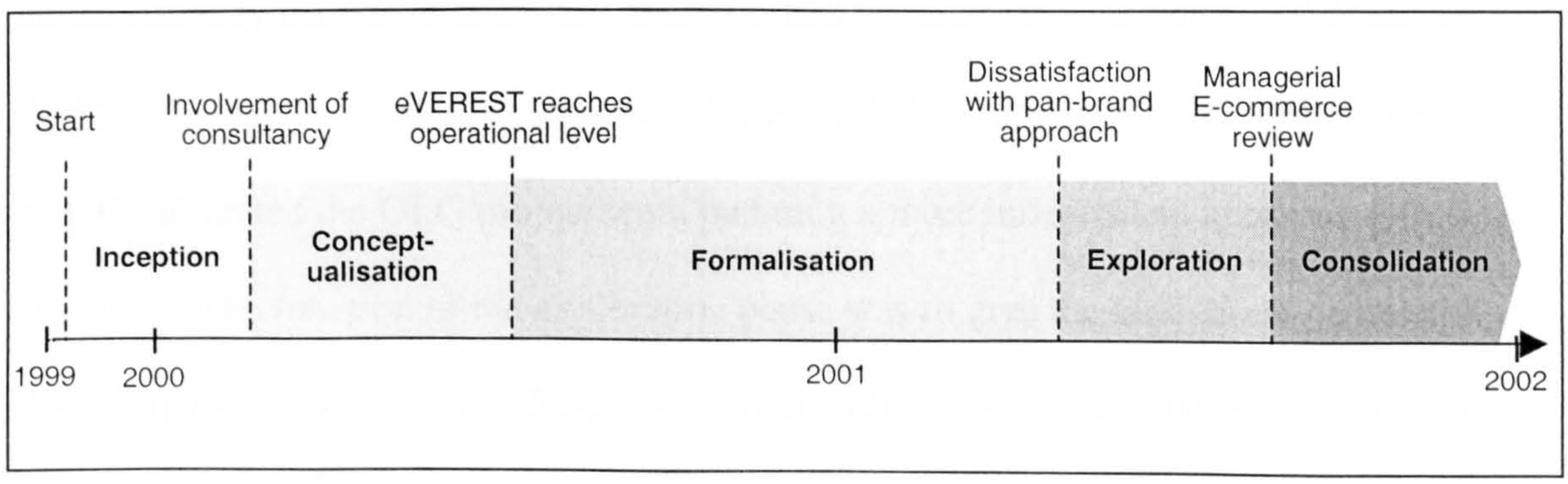


Figure 5.3: Knowledge Phases in the Integration of B2B e-Commerce at AutoCo

The characteristics of knowledge processes changed significantly once the integration of B2B e-commerce was launched as a formal project within the CarCo corporation. The knowledge phase of conceptualisation describes a period of time in which CarCo US sought to create a corporate wide e-commerce strategy, during which CarCo drew systematically on external and internal knowledge. External knowledge was brought in by the involvement of Boston Consulting, a strategy and technology consultant. The aim was to learn quickly about e-commerce applications and develop an integrated approach that would involve all global brands. This was done by involving different brands and their functions in the specification of technical and business requirements, in order to draw on internal knowledge.

The start of the eVEREST initiative at AutoCo triggered a further change in the characteristics of knowledge processes. The knowledge phase of formalisation describes a period of time in which the e-commerce strategy is operationalised and rolled out within the different organisations. The function of the formalisation phase was to establish formal organisational structures and processes for the innovation process. There was a great emphasis on planned activities and coordination across brands such as the pan-brand OLQ project team.

However, AutoCo's dissatisfaction with the lack of progress in rolling out OLQ resulted in a change in the characteristics of knowledge processes. This was attributed to the inefficient way the pan-brand OLQ team worked together, and the perceived dominance of CarCo UK. The exploration phase describes a period of time in which management at AutoCo tolerated the OLQ project team pursuing a more independent approach to rolling out OLQ. The function of the exploration phase was to give the innovation process the flexibility better to match the OLQ application with the organisational context, by utilising existing organisational relationships and processes to cope with innovations.

The characteristics of knowledge processes changed again when management at AutoCo again took greater control of the OLQ roll out. The consolidation phase describes a period of time in which the management consolidated the previous implementation activities and demonstrated their full support for the integration of OLQ. At AutoCo, management ordered users to adopt OLQ, and organisational measures were put in place to control its uptake.

5.8 Manageability of Knowledge in IT-based Innovations

During the integration of B2B e-commerce, knowledge was managed on two levels. On a knowledge process level, knowledge was managed through a mix of planned and emergent activities. On an IT-based innovation level, there were phases of control and drift that had implications for the management of knowledge. In addition, power and politics influenced management during the integration of B2B e-commerce.

5.8.1 Management Through a Mix of Planned and Emergent Activities

Knowledge processes were managed through a mix of planned and emergent activities (Alvesson and Kärreman, 2001). Figure 5.4 pulls together the findings of each knowledge process.

	Start	Involvement of consultancy	eVEREST reaches operational level	Dissatisfaction with pan-brand approach	Managerial e-commerce review	Time
Creation						
Planned →	- N/A	- Boston Consulting helps with strategy development	- Pan-brand development	- Covisint consultant - In-house development	- In-house development	
Emergent →	- Top management at CarCo US	- Individual learning	- Learning by doing	- Learning by doing	- Learning by doing	
Sharing						
Planned →	- Some meetings	- Cross-organisational workshops	- Presentations and meetings - Among pan-brand team	- Among pan-brand team	- Presentations and meetings	
Emergent →	- Among top management at CarCo US	- Social networks	- Social networks	- Boundary spanning - Social networks	- Boundary spanning - Social networks	
Retention						
Planned →	- N/A	- Senior management team - Workshop documentation	- Pan-brand team	- Pan-brand team	- Different schema - Social systems - Documentation	
Emergent →	- Individuals	- Individuals	- Individuals	- Expert - Social relations	- Expert - Social relations	

Figure 5.4: Dynamic Nature of Knowledge Processes

In a similar way to the integration of B2B e-commerce at ComCo, planned activities were an integral part of the e-commerce project management. Throughout the integration of B2B e-commerce, there was no conscious attempt at managing knowledge explicitly. Although there was a strong reliance on planned activities, particularly in the conceptualisation, formalisation and consolidation phases, they tended to be an ineffective means for facilitating knowledge processes due to two major obstacles. First, the work in the pan-brand team was impeded by political issues about the leadership of the initiative. Consequently, knowledge creation, sharing and retention in the pan-brand OLQ team were highly limited. Second, buyers in the AutoCo purchasing department were reluctant to use OLQ as it contradicted traditional organisational practice. The roll out of OLQ could not overcome such reluctance.

Emergent activities occurred as part of the ongoing social interactions and improvisations of organisational members, particularly the OLQ project team at AutoCo. Emergent activities could be both an effective and an ineffective means for facilitating knowledge processes. For example, knowledge sharing during the exploration phase was dominated by emergent activities such as informal conversations in the purchasing department about the use of OLQ. Such interaction was based on the activity of the boundary spanning individual, who drew on his social networks within the purchasing department. Still, emergent activities were less successful for retaining knowledge within the organisation. For example, during the exploration phase knowledge retention was limited to one individual who became an expert on the topic of OLQ.

Similarly to the ComCo case study, planned and emergent activities were related in two ways. First, although each knowledge process was dominated by either planned or emergent activities, there always occurred both types of activity in the same knowledge phase. For example, knowledge creation was dominated by planned activities from the

start of the eVEREST initiative. Yet there were to a lesser degree emergent activities such as learning by doing. Equally, while knowledge sharing was dominated by emergent activities in the exploration phase, there were some formal presentations to groups of buyers.

As with ComCo, while planned activities involved elements of drift, emergent activities showed elements of control. For example, knowledge sharing during the formalisation and consolidation phase was dominated by planned activities such as formal presentations to buyers. Still, even within these planned activities there was the flexibility to elaborate on and discuss specific issues that appeared to be most relevant to particular groups of buyers. In addition, emergent activities showed elements of control. For example, although knowledge sharing relied on emergent activities such as boundary spanning and networking during the exploration phase, activities did not appear incidentally. Instead, knowledge sharing was purposefully related to disseminate knowledge about OLQ among buyers in the purchasing department in order to facilitate its uptake.

5.8.2 Control and Drift

The empirical data seem to suggest that there were phases during the integration of B2B e-commerce in which knowledge processes served a particular purpose e.g. inception, conceptualisation, formalisation, exploration, and consolidation. The dominance of planned or emergent activities in each knowledge phase appears to suggest that knowledge phases can be associated with management as control or management as drift (Ciborra et al., 2000). The conceptualisation, formalisation and consolidation phases appear to be linked to management as control since they saw strong involvement of senior management from CarCo and AutoCo. The conceptualisation phase was based on planned activities for knowledge creation, sharing and retention, as interactions in the workshops were highly controlled and clearly defined. The formalisation phase was dominated by planned activities, as the roll out followed the guidelines for project management in AutoCo. The

consolidation phase saw again a strong reliance on planned activities for all three knowledge processes. Management clearly guided knowledge processes with the intention of realigning the OLQ project with the initial aims and embedding the use of OLQ in the organisational structure of the purchasing department.

In comparison, the knowledge phases of inception and exploration can be associated with management as drift because of the reliance on emergent activities. In the inception phase, it appeared that top management at CarCo US became aware of activities within CarCo US surrounding the use of B2B e-commerce applications. This was discussed on an informal basis until it was decided to establish a formal B2B e-commerce initiative. In the exploration phase, management at AutoCo gave the OLQ project freedom to match OLQ to the specific context of AutoCo and thereby ignored the collaborative approach initially demanded for the roll out. Still, knowledge creation relied on planned activities, as it involved the use of organisational resources that needed to be accounted for.

As in the ComCo case, periods of management as control also had an element of drift and vice versa. For example, the formalisation phase could be associated with management control. Nonetheless, knowledge retention still relied on emergent activities, suggesting that periods of control have an element of drift. Equally, despite the reliance on emergent activities in the exploration phase for knowledge sharing and retention, knowledge creation was dominated by planned activities. This would suggest that periods of drift have strong elements of control.

5.8.3 Influence of Power and Politics

This section looks briefly at the issue of power and politics during the integration of B2B e-commerce at AutoCo. For example, there were some underlying tensions in the relationship between AutoCo and CarCo UK. There was a common perception among AutoCo, Brand II and Brand I that CarCo UK usually tended to get strongly involved with

projects and initiatives that came from CarCo US. The same applied for the eVEREST initiative and OLQ. The formal coordination of the OLQ project lay with CarCo UK in the person of Chris Hall. CarCo UK was perceived as trying to "highjack the topic of OLQ" (purchasing manager), in order to prove itself capable of managing the different brands in Europe. CarCo UK tried to influence the initiative coming from CarCo US by reinforcing the notion of OLQ as a tool to cut costs, and to promote CarXchange as the most suitable B2B marketplace. That showed strongly in the language used by the member of the OLQ team at CarCo UK. For example, Chris Hall saw OLQ as a long-term tool to cut costs that offered "maximum leverage" and the most "cost-effective" way to purchase commodities. In addition, CarCo UK compared itself in many cases to CarCo US rather than to their European counterparts. As a result, other brands felt that CarCo UK interfered too strongly with the dissemination of ideas and knowledge concerning the adoption of the OLQ tool.

Consequently, the different brands tried to prove their independence by keeping cooperation with CarCo UK to a minimum, in order to avoid any influence. At AutoCo, this led to the independent exploration of the topic of OLQ, which effectively ignored any suggestions and influence by CarCo UK. Instead, the OLQ project team specifically tried to adopt OLQ in the context of AutoCo rather than in the context of a concerted approach for all brands. AutoCo's behaviour can also be understood as an attempt to prove to CarCo US that it was at the forefront of the integration of new technology, thereby justifying its independence within the CarCo corporation. From the AutoCo perspective, the integration of OLQ was implicitly perceived as a competition with CarCo UK. For example, the report written by Paul Turner and the researcher can be understood as a symbolic act to illustrate that AutoCo was proactive in adopting OLQ. Also in a majority of cases AutoCo took the lead in organising OLQ to prove its ability to demonstrate leadership, competency and independence.

Although OLQ can be understood as an interorganisational innovation that affects a central organisation and its suppliers, the integration of OLQ at AutoCo showed no involvement of its suppliers. Suppliers neither participated in the specification of requirements, nor were informed about the reasons for OLQ. Instead, suppliers learned about OLQ when they were asked to take part in an OLQ event. AutoCo suppliers were not powerful enough to make their position heard. As a result, suppliers tended to be hostile towards the use of OLQ as they perceived it as a threat to traditional supplier relationships, rather than as an opportunity to forge stronger links with AutoCo. In comparison, other OEMs in the automotive industry such as DaimlerChrysler and Volkswagen sought to involve suppliers by extensively communicating the purpose of, and reasons for the use of OLQ. Consequently, their suppliers appeared to feel less threatened by OLQ.

There were also severe tensions between the OLQ project team and buyers at AutoCo, as most buyers resisted the use of OLQ. There were fundamentally two major reasons for their resistance. First, OLQ was seen to destroy traditional relationships with suppliers which emphasised personal contacts and trust. Buyers argued that by only focusing on costs, softer factors such as service quality and responsiveness to product changes could not be integrated in the supplier selection criteria. Second, OLQ was also seen to change the buyer's role in the purchasing process. Traditionally, buyers spent a significant amount of time negotiating with suppliers over terms and prices, during which buyers got to know about or intensified the relation with the supplier. The use of B2B marketplaces was perceived as replacing this negotiation process with an impersonal online bidding process. Buyers felt threatened because OLQ would diminish their responsibility and scope for judgement.

5.9 Integration of B2B e-Commerce – A Summary

Similar to Figure 4.8 in the ComCo case, Figure 5.5 summarises the empirical findings regarding the innovation episodes (upper part of the figure), and knowledge processes (lower part of the figure). In addition, it shows the findings relating to five knowledge phases in the integration of B2B e-commerce at AutoCo. Regarding the innovation episodes, the start of the B2B e-commerce initiative can be traced back to autumn 1999 when top management from CarCo US put B2B e-commerce on the organisational agenda. In March 2000, CarCo officially launched its B2B e-commerce initiative by involving an external consultancy to develop a company-wide B2B e-commerce strategy called the eVEREST initiative. In July 2000, the eVEREST initiative reached the operational level at AutoCo. Among the different projects within the eVEREST initiative, OLQ was the first to be implemented while the others only developed very slowly due to the immense requirement specification. A pan-brand OLQ project team was created consisting of representatives from CarCo UK, Brand I, Brand II and AutoCo. At the beginning of 2001, OLQ was rolled out to buyers in the AutoCo purchasing department through presentations and formal meetings. In about April 2001, AutoCo pursued a more independent approach to rolling out OLQ after becoming dissatisfied with the work in the pan-brand OLQ project team, giving the project team at AutoCo the freedom to adjust OLQ to the specific organisational context. In August 2001, management at AutoCo took greater control again and reviewed the OLQ activities. There was a great thrust to develop a OLQ strategy plan for 2002 and create organisational structures to embed OLQ in the purchasing department.

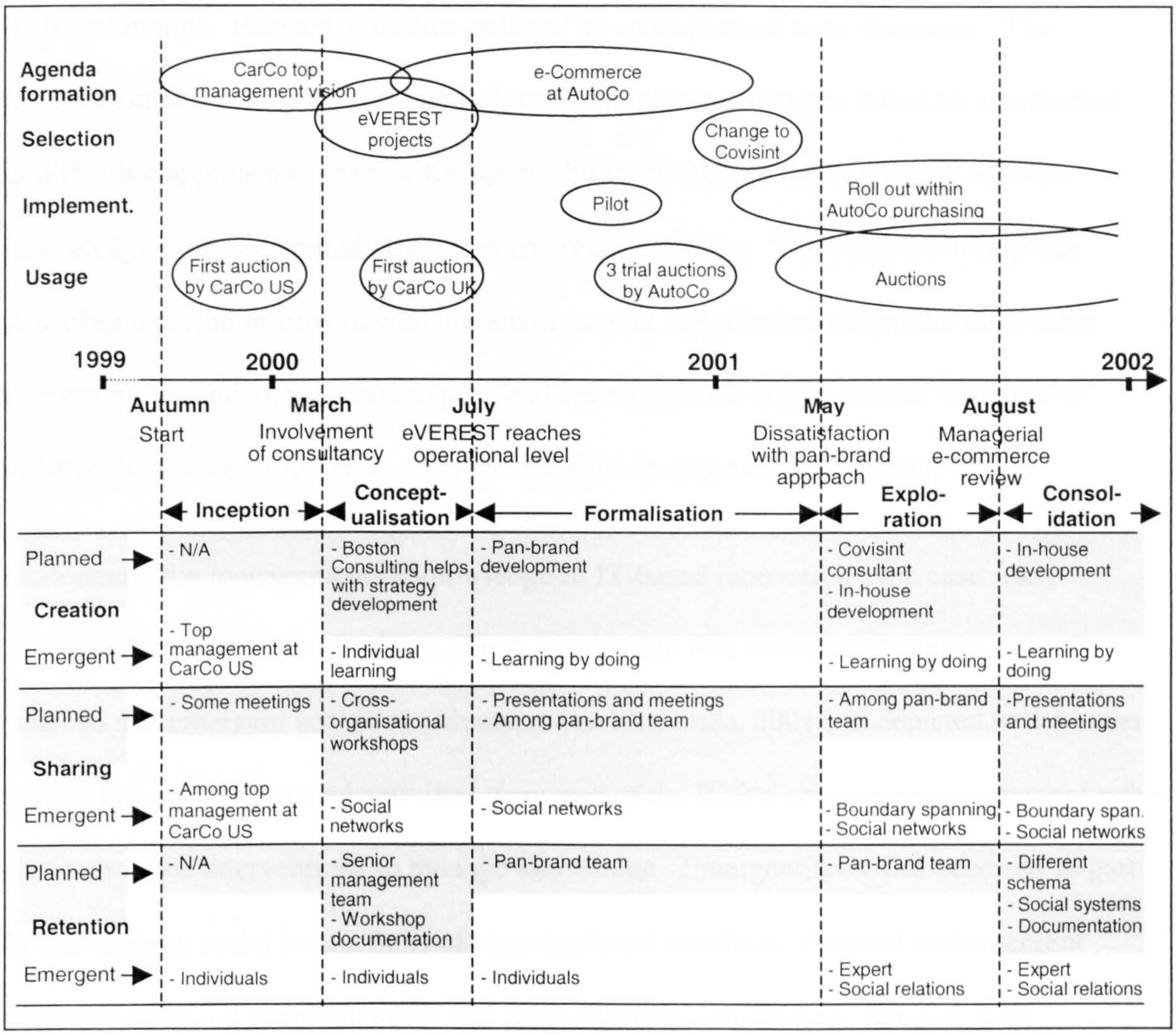


Figure 5.5: Summary of the Integration of B2B e-Commerce at AutoCo

As with ComCo case, the empirical findings also suggest that there were phases in which the characteristics of all three knowledge processes, such as the reliance on planned and emergent activities, remained unchanged. This research identified five knowledge phases in the case of the integration of B2B e-commerce at AutoCo. The first knowledge phase of inception describes a period of time in which knowledge processes supported initial contact between individuals in the organisation with the concept of B2B e-commerce, prior to the start of the formal e-commerce initiative. Knowledge processes relied mainly on emergent activities and were low in intensity. The conceptualisation phase depicted a period in which a workshop structure was put in place to develop a B2B e-commerce strategy. Here, planned activities played a major role. The formalisation phase described a period in which the B2B e-commerce strategy was operationalised and rolled out in the

different brands. Planned activities initiated by management were dominant. The exploration phase summarises a period in which middle managers relied on an informal and flexible approach to explore the applicability of OLQ in the context of AutoCo. Knowledge processes relied largely on emergent activities. The consolidation phase describes a period of time in which management at AutoCo formalised the innovation process by introducing a business plan and creating a new organisational structure to enforce the use of OLQ. Here, planned activities became more important again.

Concerning the management of knowledge in IT-based innovations, the case study revealed three significant findings. First, knowledge was managed through a mix of planned and emergent activities (Alvesson and Kärreman, 2001), as depicted in the lower part of Figure 5.5. Planned activities were part of the B2B e-commerce management rather than conscious interventions to manage knowledge. Emergent activities occurred as part of the ongoing social interactions of organisational members. Planned and emergent activities occurred simultaneously and were mutually constitutive. Second, both management as control and management as drift (Ciborra et al., 2000) occurred during the integration of B2B e-commerce. While the inception and exploration phases could be associated with management as drift, the conceptualisation, formalisation, and consolidation phases were more strongly related to management as control. Third, power and politics (Knight and Murray, 1992) affected the management of the integration of B2B e-commerce at AutoCo in that it impeded cooperation externally, e.g. with CarCo UK and suppliers, and internally, e.g. between the OLQ project team and buyers.

6. Analysis

6.1 Introduction

This chapter analyses the research findings from both case companies and relates them to previous literature. The analysis, as depicted in Figure 6.1, is conducted in four major steps, to address the two research questions about the role and nature of knowledge and its manageability in IT-based innovations. In the first step, the innovation characteristics of B2B e-commerce at ComCo and AutoCo are defined and it is argued that B2B is a knowledge-intensive IT-based innovation. In the second step, the innovation process in both case companies is outlined, first, by focusing on the three processes of knowledge creation, sharing and retention individually, and second, by analysing their interrelationship. In the third step, the role and nature of knowledge in IT-based innovation is addressed and the concept of knowledge phases is introduced, these being periods of time during the IT-based innovation in which the relationship between all three knowledge processes is based on relatively stable patterns of organisational activities. In the fourth step, issues regarding the management of knowledge in the IT-based innovation are discussed. The discussion emphasises the reliance on both planned and emergent knowledge processes, as well as the interdependence of control and drift in the integration of B2B e-commerce. This chapter concludes with a summary of the analytical findings.

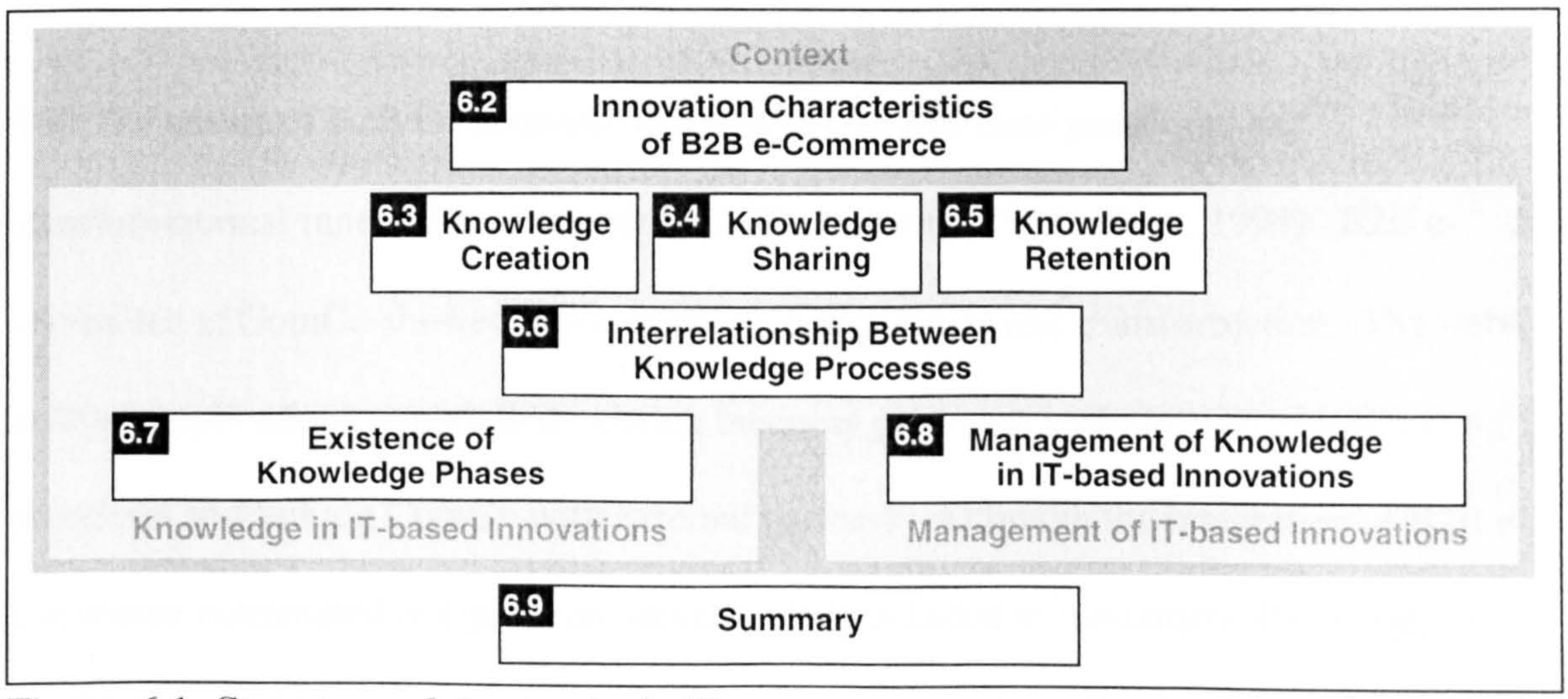


Figure 6.1: Structure of the Analysis Chapter

6.2 Innovation Characteristics of B2B e-Commerce

In this section, the characteristics of B2B e-commerce innovation are discussed and a number of reasons are given as to why B2B e-commerce can be understood as a "knowledge-intensive" IT-based innovation.

6.2.1 B2B e-Commerce Can Be an Entrenching or Altering IT-based Innovation

B2B e-commerce at ComCo and AutoCo demonstrated some similar and some different innovation characteristics. In both case companies, B2B e-commerce proved to be a complex and pervasive innovation (Timmers, 1999). It was a complex innovation because it challenged the conventional ideas about the way business was conducted. It confirms that organisations analyse the opportunities and challenges new technology offers and match them to the specific context of the organisation (Turban et al., 2000). In both case companies, this was done during a conceptualisation phase in which a B2B e-commerce strategy was defined. Also, in both case companies B2B e-commerce was a pervasive innovation (Zaltman et al., 1973). At ComCo, pervasive innovation meant that B2B e-commerce affected various organisational functions. At AutoCo, B2B e-commerce was a pervasive innovation in two ways. The eVEREST initiative aimed at integrating technology and business processes, not only across functional boundaries within one organisation, but also across same functions within the corporation. These findings both confirm the cross-functional nature of B2B e-commerce (Turban et al., 2000).

Still, the nature of B2B e-commerce differed in terms of configurational and transformational innovation characteristics (Damanpour, 1991; Fleck, 1994). B2B e-commerce at ComCo showed a low level of configuration and transformation. The web-enabled applications remodelled existing business processes with the aim of automating processes and linking ComCo with external partners. Although the integration of B2B e-commerce culminated in significant development, it failed to fundamentally change the configuration of business processes. B2B e-commerce at ComCo can therefore be

understood as an entrenching innovation (Clark and Staunton, 1989) that reinforced existing technical and social systems, rather than fundamentally changing them. This finding contradicts the commonly held notion of B2B e-commerce to be inevitably transformational (Kalakota and Robinson, 2001).

By contrast, B2B e-commerce at AutoCo showed a high level of configuration and transformation. The eVEREST initiative was clearly defined as a change project that would have significant impact on existing configurations such as IS infrastructure and business processes. OLQ was one of the eVEREST projects that altered the way AutoCo interacted with its suppliers. Therefore, B2B e-commerce at AutoCo can be understood as an altering innovation (Clark and Staunton, 1989) that reshaped the configuration through the introduction of new equipment and knowledge, so that existing technical and social systems were significantly altered. This finding confirms the dominant notion in literature depicting B2B e-commerce as causing organisational change (Timmers, 1999).

The conflicting findings of B2B e-commerce being both an entrenching and altering IT-based innovation indicate that integration of B2B e-commerce does not have a deterministic effect on the existing technical and social systems, but is dependent on the organisational context and managerial frames of reference. This contradicts the vast majority of current literature which implicitly assume that B2B e-commerce inevitably and fundamentally changes organisations and whole supply chains (Timmers, 1999; Scully and Woods, 1999). More generally, the findings support recent criticism of the perceived notion of IT as an exogenous and autonomous monolith that has a deterministic, unidirectional impact on organisational properties and human behaviour (Orlikowski and Iacono, 2001). Instead, the integration of IT is bound up with the contextual aspects such as the availability of resources or management support – aspects that might vary widely between organisations. With regards to the research questions, this implies that the

management of knowledge during the integration of B2B e-commerce can equally vary between organisations.

6.2.2 B2B e-Commerce Is a Knowledge-Intensive IT-based Innovation

It has been argued in section 2.2.4 that B2B e-commerce would be particularly suitable to research knowledge for the purposes of IT-based innovations. The findings in both case studies indicate that B2B e-commerce can be understood as a knowledge-intensive IT-based innovation for a number of reasons. One main reason is that B2B e-commerce was still a highly vague concept when this research was started, which required intense sensemaking, in order to form assumptions and expectations about it (Orlikowski and Gash, 1994). This confirms that B2B e-commerce can be understood as an equivocal technology that admits several possible and plausible interpretations by different social communities (Weick, 1990). Interpreting B2B e-commerce and its organisational implications proved to be particularly difficult. First, in introducing B2B e-commerce, both ComCo and AutoCo simply could not replicate prior experience such as lessons learned or industry recipes (Spender, 1989). Instead, the case companies had to go through an organisation specific learning experience to explore B2B e-commerce more fully. Second, web-based technology such as programming languages and server hardware were still evolving. This made it difficult to identify those applications that would become future standards. Equally, hardware such as servers became increasingly powerful, thus offering higher levels of functionality such as improved firewalls. Identifying the right timing for the purchase of hardware was very difficult.

Another reason for the knowledge intensity was that B2B e-commerce involved significant levels of knowledge creation both in cooperation with external parties and through internal development. Working with external parties such as strategic consultancies was important in order to create an conceptual understanding of B2B e-commerce from which an organisational strategy could be derived. Particularly at AutoCo, the involvement of top

management indicates that B2B e-commerce was considered to be crucial as one of the key strategies for the CarCo Company. Equally, the internal development of B2B e-commerce was important so as to match applications with the specific context of the organisation (Clark and Staunton, 1989). For example, at ComCo the integration of B2B e-commerce software and hardware involved many trial and error attempts. Knowledge creation was mainly achieved through learning by doing, during which the understanding of B2B e-commerce kept changing. This confirms the findings by Scarbrough (1995) that the less standardised and the more organisation specific the knowledge requirements of a particular project are, the greater the role of internal development.

A further reason for the knowledge intensity of B2B e-commerce was that claims to knowledge were strongly contested by internal and external social communities, as the integration of B2B e-commerce challenged existing business processes and required changes to the legacy systems (Timmers, 1999). This would suggest that B2B e-commerce is a disruptive technology and is knowledge-intensive to such a degree that it disturbs existing power relations both within the organisation and between organisations (Scarbrough and Corbett, 1992; Bower and Christensen, 1995). Although B2B e-commerce affected different social communities simultaneously, there tended to be low levels of cooperation. For example, the coordination between AutoCo and other CarCo companies was impeded as each organisation sought to protect its independence. Even within the organisation, the integration of B2B e-commerce relied on the initiative of individuals or small groups who constructed knowledge and sought to promote their assumptions and expectations of B2B e-commerce. For example, as the community of practice at ComCo was the focal point for knowledge creation, sharing and retention, it promoted its notion of B2B e-commerce over contrary perspectives held within ComCo. Due to the contested nature of knowledge, different notions of B2B e-commerce coexisted in organisations.

It could be argued that B2B e-commerce at the current stage of development is more knowledge-intensive than other IT-based innovations such as BPR or ERP that are more clearly definable. B2B e-commerce is currently still more subject to interpretation than those more mature concepts for which there are, at least rhetorically, clearer organisational implications and applications (Galliers, 1998). Also, knowledge creation is likely to be less intensive once technical standards have emerged and technology suppliers offer more off-the-shelf packages. However, as B2B e-commerce is a pervasive and potentially transformational IT-based innovation, knowledge is likely to remain contested, as other interorganisational innovations such as EDI indicate (Swatman and Swatman, 1992).

After having outlined the innovation characteristics of B2B e-commerce, the next step is to analyse the three processes of knowledge creation, sharing and retention. These knowledge processes were identified in the literature review to be crucial for the understanding of both the nature and role of knowledge, as well as the manageability of knowledge in IT-based innovations. The category of knowledge phases which was introduced in the case studies descriptions and is conceptualised in greater detail further below, is used to refer to specific periods during the integration of B2B e-commerce.

6.3 Knowledge Creation

This section outlines the fact that knowledge creation was an ongoing process that involved sensemaking and learning about B2B e-commerce. Knowledge was created both in the interaction with external consultancies and IT vendors and through internal development. Throughout the IT-based innovation, knowledge creation tended to be systematic and planned, rather than ad-hoc and emergent.

6.3.1 Knowledge Creation Relies on Planned Activities

The empirical findings indicate that with the exception of the inception phase at both case companies, knowledge creation was based on planned activities. In the conceptualisation

phase, planned activities such as workshops, audits and meetings were used as a means for the organisation to structure knowledge creation. In the formalisation phase at AutoCo, management wanted to standardise the use of OLQ in different brands. Therefore, a formal pan-brand OLQ team was created which had a clear function, operational responsibility and reporting structure. During the consolidation phase in both companies, senior management re-emphasised the importance of formal procedures to organisational members. The findings support the implicit notion in IS development literature that structured and formal activities such as the specification of requirements and the establishment of a formal project structure play a major role in knowledge creation (Hallows, 1998).

However, it was surprising that planned activities for knowledge creation were also dominant in the exploration phase at both companies. Although project members were given the organisational freedom to explore the issue of B2B e-commerce in the specific organisational context, they used largely planned activities to create knowledge. At ComCo, for example, the purchase of software and the internal development of applications included formal procedures to evaluate and test external software, drawing up standard contractual agreements, formal workshops and meetings. Equally, internal development was guided by existing IS development methodologies, which emphasised a formal and planned approach. Similarly, at AutoCo, knowledge creation in cooperation with external consultancies involved formal meetings and workshops.

There appears to be two potential explanations for the reliance on planned activities for knowledge creation. First, knowledge creation involved the use of limited organisational resources. Financial resources were needed to acquire consultancy services, and software and hardware products. Any transactions with business partners, which involved financial payments, were traditionally formalised and highly planned. Organisational resources such as "manpower", which were needed for internal knowledge creation, had to be accounted

for in annual budget meetings. Since financial and organisational resources were limited, their use tended to be planned and prioritised.

Second, knowledge creation appeared to reflect a certain style or organisational routine of how organisations integrate new knowledge (Nelson and Winter, 1982; Cohen and Levinthal, 1990). At ComCo, knowledge creation tended to follow a slow but thorough methodology, which guided any IS implementation project. At AutoCo, management wanted to appear as supporting a pan-brand approach to knowledge creation, but actually supported a AutoCo specific approach. This suggests that organisational routines are significant for the way knowledge is created. Rather than being a free and creative process that starts with a "blank page", it is constrained by behavioural patterns that implicitly guide the way knowledge is created.

6.3.2 Change from External to Internal Knowledge Creation

The empirical findings in both case studies suggest that knowledge creation initially relied on external sources and later on in-house development. In the conceptualisation phase, both case studies drew extensively on consultancies for two purposes. First, by drawing on external consultancies that readily provided such generic frameworks as IBM Global Consulting's differentiation between Internet, intranet and extranet, management would save time in understanding the discussion about e-commerce compared to exploring the topic themselves. Second, managers wanted to develop an e-commerce strategy for their organisations. It was believed that consultancies had both up to date knowledge about the latest technological applications and an awareness of lessons learned about their implementation and use in other companies. This approach to knowledge creation resembles a blackboxing strategy, by drawing on external consultancy expertise to learn quickly about potential e-commerce applications (Scarbrough, 1995). Previous research had exclusively related the blackboxing strategy to the acquisition of objectified artefacts such as off-the-shelf hardware and software packages (Wilson et al., 1994). The findings

also draw attention to generic or "off-the-shelf" frameworks, in the form of consultancy models and concepts that are acquired by organisations to understand new phenomena such as B2B e-commerce.

After the conceptualisation phase, internal development and learning by doing became the dominant form of knowledge creation (Scarbrough, 1995). Internal knowledge creation appeared to be necessary in order to develop the operational capability internally to enable the e-commerce strategy. In-house development largely involved e-commerce project team members, users and middle managers, who worked according to the specifications of the e-commerce strategy. Although consultancies provided some external expertise in the form of predefined software packages or hosted applications, organisational members needed to learn how to apply it to the specific organisational context. In both case companies, there was a strong tradition of developing the in-house expertise to gain a profound knowledge of how to manipulate and change software and applications. For example, at ComCo it was necessary to link new applications to the existing legacy systems. At AutoCo, the use of OLQ had to reflect the current business processes in the purchasing department. This approach to knowledge creation resembles a prisoner strategy as detailed in section 2.5.1, that emphasises the importance of in-house development for the creation of knowledge (Scarbrough, 1995).

The findings in this research extend the concept of strategies for the creation of knowledge in IT-based innovations (Scarbrough, 1995). While Scarbrough (1995) suggests that organisations exclusively adopt one strategy for knowledge creation, the empirical findings suggest that organisations can change strategies during the integration of B2B e-commerce. Furthermore, external and internal sources appeared to fulfil different functions regarding knowledge creation. Both companies used external expertise to gain a conceptual understanding of the e-commerce topic and develop an e-commerce strategy. This enabled them to learn quickly about new technological developments. Internal development was

necessary to integrate new knowledge in the form of technology and organisational processes into the organisational context. Such integration appeared on an operational level and required time.

6.3.3 Sensemaking of B2B e-Commerce

Both case studies showed great differences regarding the start and continuity of sensemaking. At ComCo, initial sensemaking on an individual basis started during the inception phase. However, such sensemaking was sketchy and dispersed, aptly reflecting the emergent nature of the IT-based innovation. Significant sensemaking on an organisation-wide basis started in the conceptualisation phase, when people from different functions worked together to define what B2B e-commerce would mean for ComCo and how it could be applied. This finding supports existing research which suggests that organisations are most susceptible to sensemaking when they encounter new technology (Weick, 1990, Griffith, 1999). The time of encounter in the case of ComCo would not be the earliest time when individuals came across B2B e-commerce, but when there was a concerted effort to learn about new technology.

The literature on sensemaking suggests that sensemaking would congeal quickly after the initial introduction period (Tyre and Orlikowski, 1994). Yet at ComCo, sensemaking appeared to continue on an intense level throughout the IT-based innovation. This might be explained by the specific properties of B2B e-commerce that can trigger more challenging and ongoing sensemaking (Weick, 1990; Griffith, 1999). The integration of B2B e-commerce at ComCo was accompanied by a high level of unpredictability, which presented a permanent source of uncertainty to organisational members (Weick, 1990). Each of the numerous individual projects provided learning opportunities not only within the project but also affected other projects. For example, the supplier schedule project required staff to learn about how to present information online. Such expertise, in turn, was also needed for projects dealing with dealers. At the same time, the lack of funding

only enabled ComCo to implement projects piecemeal, rather than in one intensive but short go. Therefore, the projects were implemented in small incremental steps that prolonged sensemaking. In the case of ComCo, it could be argued that what Tyre and Orlikowski (1994) describe, as the initial introduction period of new technology was extended and ongoing.

In contrast, sensemaking at AutoCo displayed a different dynamic in terms of sensemaking. Similar to ComCo, it appeared that there was a low level of sensemaking in the inception phase, as individuals at CarCo US tried to learn about the new technology. At AutoCo itself, B2B e-commerce was not an issue during that early time. In the conceptualisation phase, sensemaking at AutoCo was confined to a few senior managers from AutoCo who were involved in the pan-brand workshops. Sensemaking on an operational level at AutoCo started in the formalisation phase, when B2B e-commerce was rolled out to the different brands. However, it appears that there was only limited sensemaking, both within the pan-brand OLQ project team and among users at AutoCo. The reason for this appears to be twofold. First, management wanted the pan-brand OLQ team to construct a common approach to the implementation and use of the application, which was implicitly resisted by the different brands. Second, buyers at AutoCo perceived OLQ as just another "flavour of the month" that would not have any lasting organisational implications. Hence, B2B e-commerce was perceived not to have specific properties which would have triggered more challenging sensemaking (Weick, 1990). As a consequence, the initial sensemaking at AutoCo was subdued, which would contradict the findings by Tyre and Orlikowski (1994), that sensemaking is most intensive during the initial introduction period.

Sensemaking at AutoCo was most intense during the exploration phase, when the OLQ team was given the freedom to better adjust OLQ to the organisational context. Here, learning by doing appeared to trigger sensemaking, as both the OLQ team and users learnt

how and when to use OLQ to purchase commodities. After this period, sensemaking congealed quickly and the technological frames of different organisational groups remained stable. As outlined in section 2.5.3, this would support the argument made by Tyre and Orlikowski (1994) that the "window of opportunity" for a change in the organisational understanding of technology is relatively short.

6.4 Knowledge Sharing

This section outlines that knowledge sharing was an ongoing process, during which planned and emergent activities contributed in different ways to knowledge sharing. Knowledge sharing across different social communities was facilitated by a community of practice at ComCo and a boundary spanning individual at AutoCo. Although B2B e-commerce can be understood as an interorganisational innovation that requires different organisations to work together, there was a lack of knowledge sharing between organisations.

6.4.1 Different Roles of Planned and Emergent Activities

The findings suggest that planned and emergent activities each played a different role in sharing knowledge during the integration of B2B e-commerce. Planned activities were related to project teams (Hallows, 1998) and mainly used in the collaboration with external consultancies and in the internal roll out of B2B e-commerce. The main mechanisms for sharing knowledge with external consultancies were formal meetings between the project team and the consultants. The main mechanisms for the internal roll out of B2B e-commerce were presentations by project team members to users, usually followed up by meetings. However, such planned activities tended to result in a low degree of knowledge sharing. Different technological frames prevented knowledge sharing in interorganisational teams such as the pan-brand OLQ project team at AutoCo (Gibbons, 1994; Orlikowski and Gash, 1994). Equally, knowledge sharing within the organisation was impeded, as organisational members such as project team members and users had

different assumptions and expectations about the technology (Brown, 1998). Instead, the benefit of planned activities can be seen in informing organisational members about the status and expectations of B2B e-commerce rather than developing a shared understanding of the new technology.

However, planned activities could provide an opportunity for knowledge sharing, as the conceptualisation phase in ComCo demonstrated. A potential reason might have been that people involved showed a high level of personal commitment to the idea of using B2B e-commerce. At ComCo, the initiative was, as outlined earlier, strongly driven by middle managers who wanted to learn more about B2B e-commerce. Collaboration with the external consultancy was seen as an important way to develop the necessary expertise in-house. Knowledge sharing was facilitated by engaging actors with relevant knowledge in cross-functional workshops (Wilson et al., 1994), which created a common understanding of the innovation (Gibbons, 1994). In contrast, workshops and meetings at AutoCo were largely seen as satisfying the requirements set by CarCo US. Participants from AutoCo felt that their main purpose was to supply information so that the consultancy could develop a B2B e-commerce strategy. Here, the lack of commitment and different agendas impeded knowledge sharing between organisations (Hansen, 1999).

Emergent activities for knowledge sharing were most important during the exploration phase in both case companies. The main mechanisms were informal meetings and casual conversations about issues surrounding the integration of B2B e-commerce. In the case studies, different social communities were important for emergent activities. At ComCo, the community of practice consisted of a group of people who knew each other from working together previously and had developed either a professional or personal relationship (Brown and Duguid, 1998). At AutoCo, social networks were key to sharing knowledge between project team members and buyers (Hislop et al., 2000). Existing personal relations were important for overcoming buyer resistance to OLQ. Although

emergent activities such as meetings were similar to those of planned activities, they involved a high degree of knowledge sharing. This finding supports existing literature, as outlined in section 2.6.2, which identified the importance of communities of practice and social networks for knowledge sharing (Brown and Duguid, 1998; Newell et al., 2000). However, knowledge sharing was limited to the members of the community of practice and social networks. It effectively excluded a high number of other organisational members who were affected by the integration of B2B e-commerce.

The findings suggest that planned and emergent activities contributed in different ways to knowledge sharing. While planned activities support the dissemination of ideas of B2B e-commerce to a great variety of organisational members, they do not necessarily facilitate intense knowledge sharing. In contrast, emergent activities enable intensive knowledge sharing but are limited to a relatively small group of people. The findings also challenge the body of literature, detailed in section 2.6.3, that advocate ICT as a means of sharing knowledge (Grover and Davenport, 2001; Stein and Zwass, 1995). ICT such as e-mail was merely used to arrange meetings or send updates of electronic files such as minutes of meetings and presentations. By contrast, knowledge sharing relied fundamentally on social processes that required face-to-face interaction (Pentland, 1995).

6.4.2 Limits of Communities of Practice and Boundary Spanning Individuals

Both case companies had different mechanisms to promote knowledge sharing between different social communities. At ComCo, the community of practice was instrumental in linking disparate bodies of knowledge held by different functions such as MIS, marketing or parts, resulting in a high level of absorptive capacity with regard to the integration of B2B e-commerce (Cohen and Levinthal, 1990). Due to the combination of frequent restructuring and low turnover, organisational members tended to have worked in different departments and developed a level of common knowledge. This made it much easier for members of the community of practice both to share knowledge between themselves and to

appreciate the diversity of knowledge at ComCo. The community of practice was able to promote knowledge sharing by bridging the specialised knowledge held by different functions. The findings confirm that communities of practice allow members to share their knowledge in an inhibited way (Wenger and Synder, 2000).

At AutoCo, knowledge sharing between social communities such as the project team and the purchasing department was mediated by a boundary spanning individual who was a member of the project team (Tushman and Scanlan, 1981). The boundary spanning individual stood at the interface of both the organisation and the external environment, and between social communities. Externally, the boundary spanning individual interacted with the CarXchange consultant, academic researchers and other purchasing professionals. Internally, the boundary spanning individual was at the interface between the project team and the purchasing department. The individual drew largely on social networks he had developed inside and outside the organisation. The findings confirm the importance of boundary spanners who act as mediators between different fields of specialised knowledge (Macdonald and Williams, 1992). The findings also confirm that for being important for the innovation process, they not only need to interface with a variety of social communities but also be influential within the organisation (Tushman and Scanlan, 1981). Being a key member of the project team, the boundary spanning individual at AutoCo had key responsibility for the operational roll out of OLQ.

Contrary to most of the literature (e.g. Robertson et al., 1996; Wenger and Snyder, 2000), there was a potentially negative side to the community of practice, social networks and boundary spanning in terms of knowledge sharing. First, mediators such as the community of practice and the boundary spanning individual used knowledge sharing to establish their notion of B2B e-commerce as the dominant construction of knowledge about the new technology (Swan et al., 1998). The community of practice at ComCo was motivated by the members' belief that B2B e-commerce could add significant value to the organisation.

Therefore, their agenda was to prove the benefits of B2B e-commerce, which was a coherent theme in the interaction with other social communities. Knowledge sharing was aimed at promoting the benefits and at countering reservations or criticism. For the boundary spanning individual at AutoCo, the OLQ project was his first big assignment and he was keen to prove to superiors his ability to manage the roll out successfully. The individual interpreted OLQ as a valuable tool to cut costs, whereas buyers saw it to be a threat to existing supplier relations and their job responsibility. Hence, knowledge sharing sought to encourage buyers to take up OLQ by emphasising its advantages and downplaying problems such as the effect on traditional supplier relationships and trust.

Second, findings in both case studies showed that knowledge sharing was exclusive to the members of the community of practice and social networks. Yet, these members were only a fraction of the people affected by the integration of B2B e-commerce. For example, the community of practice at ComCo consisted of four people who shared knowledge intensively. In comparison, there were about 60 organisational members in different functions who were either involved in the B2B e-commerce initiative or whose job would be affected by new applications. Interviews and conversations with members of the community of practice gave a rough indication that only a third of the organisational members affected by B2B e-commerce were connected through social networks. Equally, at AutoCo social networks appeared to include only a small number of the buyers who were supposed to use OLQ. This meant, in effect, that the majority of people affected by B2B e-commerce were not involved in knowledge sharing at all.

These findings strongly contradict the majority of literature that treats communities of practice and social networks as outright positive in terms of their effects on knowledge sharing (Wenger and Snyder, 2000; Hansen, 1999). Instead, the findings suggest that they promote specific notions of B2B e-commerce over others and exclude a high number of organisational members who were affected by the integration of B2B e-commerce. The

absence of more critical analysis might be understood because communities of practice and social networks have been mainly researched in the context of incremental change such as copier maintenance (Orr, 1990) or infrastructure development (Storck and Hill, 2000). While communities of practice and social networks appear to facilitate knowledge sharing in incremental innovations (Orr, 1990; Hislop et al., 2000), they may inhibit knowledge sharing in more radical innovations. For example, in a study of technological innovation, Garud and Rappa (1998) point out that communities of practice can easily fail to recognise quite damning evidence owing to the limitations of their own world view, and thus inhibiting organisational change. As radical innovations tend to require the cooperation of different social communities, the exclusive membership of communities of practice and social networks may also create boundaries, which inhibits wider knowledge sharing.

6.4.3 Lack of Knowledge Sharing with External Social Communities

B2B e-commerce has been hailed not only as integrating an organisation with its value chain members, but also as fostering coordination within large corporations (Moore and Ruddle, 2000). To achieve such integration and coordination, it could be assumed that different organisations would work together and share knowledge. Surprisingly, at both case companies, knowledge sharing with value chain members and other organisations was highly limited. There was hardly any form of communication with value chain members. At ComCo, neither suppliers nor dealers participated in any decision-making about B2B e-commerce applications. At AutoCo, suppliers were not informed about OLQ until they were asked to participate in an OLQ event. Equally, there was very little coordination between organisations within the same corporation. At ComCo, there was no common initiative with Fendt or other US companies owned by WorldCo. At AutoCo, the pan-brand OLQ project team did not encourage or enforce knowledge sharing between different brands within the CarCo corporation.

The empirical data suggests two potential reasons for the lack of knowledge sharing with such external social communities. One reason could be that the strong locally embedded nature of knowledge prevented knowledge sharing across organisations (Brown and Duguid, 1998). Despite the interorganisational nature of B2B e-commerce, knowledge sharing was impeded by different organisational practice and standards, which could not be overcome by the creation, for example, of pan-brand project teams.

The other perhaps more important reason could be related to power and politics, as outlined in section 2.4.4. In both case companies, the integration of B2B e-commerce was seen as an opportunity to re-enact the independence and superiority of the organisation within a larger corporation. For example, ComCo continued with B2B e-commerce despite the budget rejection by WorldCo and AutoCo explored OLQ independently, to show their superiority in adopting innovations coming from CarCo US. At the same time, both case companies perceived themselves as the dominant core of their value chain that set rules and standards for other value chain members. From this perspective, it would not be necessary to share knowledge with other organisations that were perceived to be less important value chain members. As a result, the organisational endorsement mechanisms prevented ComCo and AutoCo from acknowledging that other organisations would be able to contribute to the integration of B2B e-commerce (Brown and Duguid, 1998). In contrast, both case companies had no problem in sharing knowledge with external social communities such as consultancies. This seems to suggest that besides endorsement mechanisms, the willingness of social communities to engage with others and their commitment to do this plays a major role in knowledge sharing.

6.5 Knowledge Retention

This section outlines the fact that knowledge retention was an ongoing process. Knowledge retention was fundamentally a social process, and knowledge necessary for the integration of B2B e-commerce was largely embodied in individuals who became experts

in their field, as well as in social relations that these experts developed during the innovation process. Contrary to the view highlighting the advantages of retained knowledge for the ability to innovate (Grant, 1996a), previous knowledge retained in organisational routines had not only a facilitating but also a restraining influence on the integration of B2B e-commerce.

6.5.1 Different Approaches to Knowledge Retention

Both case studies showed great differences regarding the way knowledge was retained during the integration of B2B e-commerce. The case description of ComCo illustrated that for a large part of the innovation process, knowledge retention tended to depend on emergent activities. This appeared to be related to the absence of a high profile e-commerce initiative that would receive funding and support by senior management. Knowledge about B2B e-commerce was largely retained in two ways. First, the community of knowledge held shared schema about the purpose and application of B2B e-commerce (Walsh and Ungson, 1991). Second, physical systems such as the use of new hardware and software retained knowledge about B2B e-commerce (Clark and Staunton, 1989).

At AutoCo, planned activities for knowledge retention played a more important role. This appeared to be related to the support of senior management, who demanded a formal roll out of B2B e-commerce. Knowledge about B2B e-commerce was retained in several ways. First, OLQ introduced a new operating procedure for purchasing commodities (Walsh and Ungson, 1991). Second, management altered the social system by introducing new formal positions, such as the role of "e-belts" and "operational OLQ co-ordinators" (Stein, 1995). Surprisingly, the use of OLQ did not change physical systems such as legacy systems, as the application was hosted by CarXchange externally. Still, other projects in the eVEREST initiative clearly involved a substantial reconfiguration of legacy systems. Also, knowledge retained in schema was highly group specific as, for example,

buyers and management attached different assumptions and values to the use of OLQ (Orlikowski and Gash, 1994).

The findings draw attention to two areas. First, the use of ICT for storing information about the integration of B2B e-commerce was highly limited. This finding questions the usefulness of knowledge repositories that would be used to retained codified knowledge as electronic files (Stein and Zwass, 1995; Grover and Davenport, 2001). Instead, the findings suggest that knowledge retention is a fundamentally social process. Second, while the integration of B2B e-commerce resulted in a low degree of collective knowledge retention at ComCo, it showed a higher degree at AutoCo. This is also reflected in the different characteristics of B2B e-commerce as outlined in the first section, by being an entrenching IT-based innovation at ComCo and an altering one at AutoCo (Clark and Staunton, 1989). The findings suggest that planned activities initiated by senior management are needed for knowledge retention in social systems, e.g. organisational structure, and scripts, e.g. operating procedures.

6.5.2 Importance of Experts

As knowledge retention was fundamentally a social process, much of the knowledge necessary for the integration of B2B e-commerce was embodied in individuals. Such individuals became experts who retained knowledge in the form of both professional and relational knowledge (Scarbrough, 1999). The difference between the case companies was the number of experts in B2B e-commerce. While there were a number of experts in different fields such a project management and IS infrastructure at ComCo, there was only one expert at AutoCo. This is likely to be related to the difference in scope of B2B e-commerce in both case companies. It appeared that there were key experts in both case companies who were the central point for other people to refer to when they wanted to learn more about B2B e-commerce (Cross and Baird, 2000). In both case companies, the name of the key experts became a synonym for B2B e-commerce. New knowledge about

B2B e-commerce extended the existing professional skills (Scarbrough, 1998). These people became experts as part of their day-to-day involvement with the project, rather than due to planned training sessions and intended management intervention.

In addition to extending their individual specialised knowledge, experts also developed relational knowledge about who else inside or outside the organisation could support problem-solving and decision-making (Anand et al., 1998; Cross and Baird, 2000). In both case companies, relational knowledge was based on different social mechanisms. At ComCo, key experts belonged to the community of practice, which developed during the integration of B2B e-commerce (Brown and Duguid, 1998). The community of practice provided a forum for drawing on other experts' knowledge. For example, while Robert Miles was the expert for project management, Eric Taylor and later John Payne had extensive knowledge of the impact of B2B e-commerce on the legacy systems. As indicated above, the advantage of communities of practice lies in the ability to bring together different experts who can easily share knowledge. At AutoCo, the expert relied on building social networks to draw on the expertise of other experts such as the CarXchange consultant and buyers (Hislop et al., 2000). Such informal structures emerged out of the daily activities involved in the integration of B2B e-commerce, rather than being consciously planned or controlled.

The findings confirm earlier studies that knowledge necessary for the integration of IT-based innovations is embodied in people (Markus and Benjamin, 1996; Scarbrough, 1999). Experts had specialised knowledge about B2B e-commerce which was part of their professional expertise. Although B2B e-commerce relied on the combination of strong technical skills with adequate business knowledge, this was not achieved through hybrid managers (Earl, 1989). Instead, experts developed relational knowledge that would enable them to draw on the bodies of knowledge of other experts, rather than developing it themselves (Cross and Baird, 2000).

6.5.3 Facilitating and Restraining Influence of Organisational Routines

Both case companies drew on existing knowledge in the form of organisational routines (Nelson and Winter, 1982), which had both a facilitating and a restraining influence on the integration of B2B e-commerce. In terms of facilitation, it enabled knowledge about new technology to be linked with existing knowledge about technical and social systems (Clark and Staunton, 1989). In the case of ComCo, organisational routines such as project management and IS development methodologies ensured that new technology would fit into the customised legacy systems. At AutoCo, the creation of pan-brand teams was part of the organisational procedure to roll out innovations across different brands. Although there were inherent problems with collaboration inside the pan-brand team, it nevertheless created an opportunity for experts to pool their knowledge. The research supports earlier findings that organisational routines provide the ability to develop a short-term organisational response to unfamiliar environmental stimuli such as the integration of B2B e-commerce (Pentland and Rueter, 1994).

Still, organisational routines restrained the integration of B2B e-commerce through being less open to new ideas that would bring organisational change. At ComCo, existing IS development methodology meant that any new technology had to be developed and tested extensively. Testing was needed to make sure that new applications would interact with existing ones, and if there were any doubts, the MIS department would reject the new technology. One person compared the MIS department with a tanker that moved very slowly and needed a long time to turn around. Instead, the person added, B2B e-commerce would require a speedboat approach, implying that applications need to be rolled out quickly to reap benefits. At AutoCo, the standard project management methodology led buyers to believe that OLQ was just another short-life project that would fizzle out quickly. As a result, it was difficult to commit buyers to the project. The findings confirm that organisational routines can be perceived to be an inappropriate response to environmental

stimuli (Cohen and Bacdayan, 1994). This finding sheds a more critical light on the discussion of organisational capabilities, which tend to portray organisational routines as out and out positive but ignore that retained knowledge can limit what could be retained subsequently (Hamel and Prahalad, 1994).

The integration of B2B e-commerce in both case companies failed to change organisational routines such as project management and IS development methodologies. As outlined earlier, B2B e-commerce at ComCo was an entrenching innovation that caused limited organisational change. More surprisingly is the stability of organisational routines at AutoCo. Although management required buyers to use a new business process for the purchase of commodities, fundamental routines such as how buyers organise their work and interact with suppliers remained unchanged. At the time of the empirical research, the new business process was neither part of the behavioural pattern of buyers nor part of the "organisational unconsciousness" which are both definition criteria for organisational routines (Cohen and Bacdayan, 1994). Yet there appeared to be a strong tendency that the new business process would become an organisational routine, as management created new organisational structures and performance measures to enforce a new behaviour pattern. The findings support the argument that while organisational routines are relatively stable, they can change over time (Feldman, 2000).

6.6 Interrelation Between Knowledge Processes

In the previous three sections, findings for each of the three processes of knowledge creation, sharing and retention were outlined separately. The next step is to analyse the interrelation between these knowledge processes. Although previous knowledge process frameworks acknowledge the interrelation between knowledge processes (Pentland, 1995; Alavi and Leidner, 2001), they remain silent on what form this interrelation takes. As depicted in Figure 6.2, the findings in this research suggest two characteristics of the

interrelation between knowledge processes, namely non-linearity and conjunction, which will be outlined here.

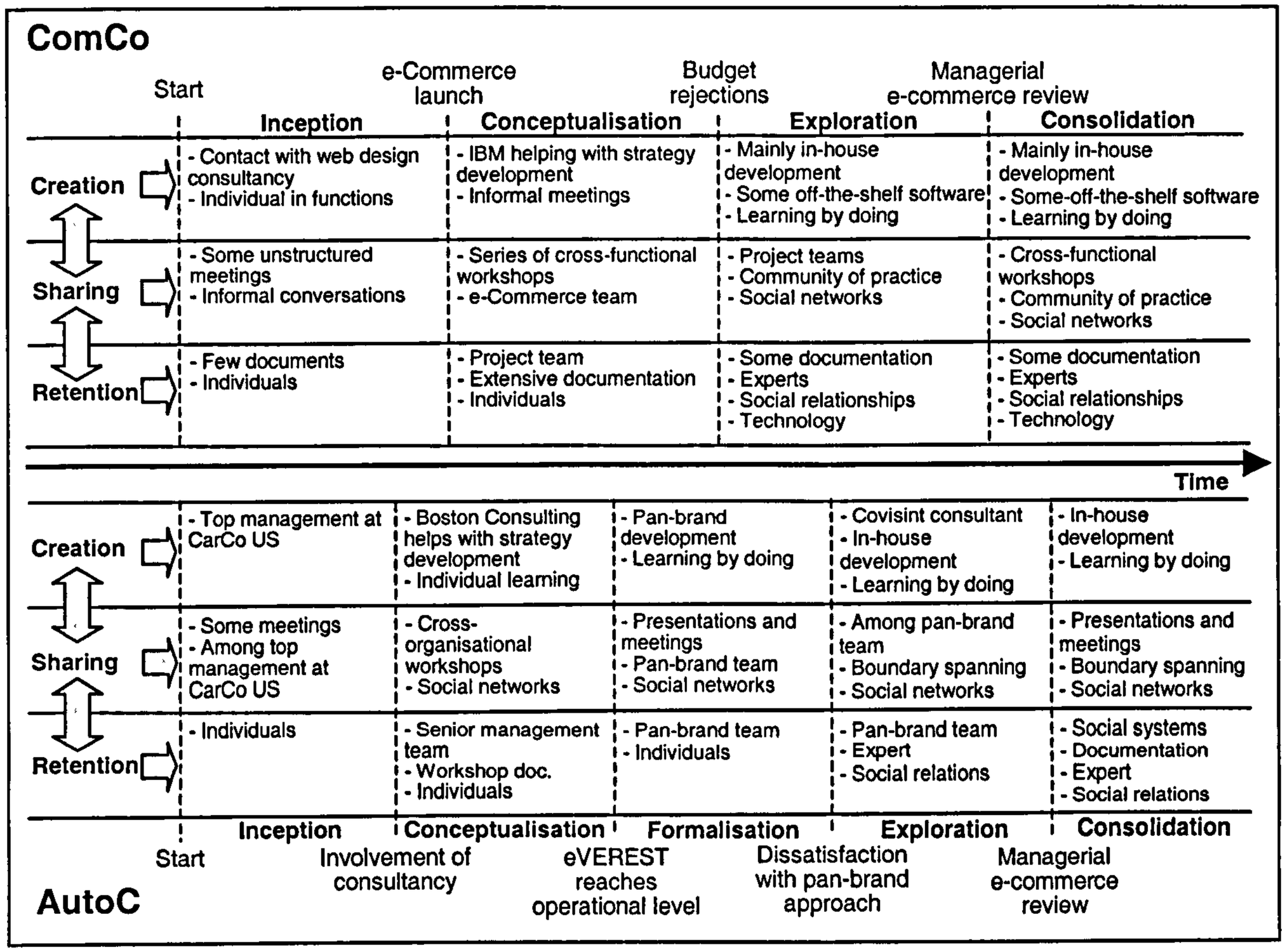


Figure 6.2: Interrelation of Knowledge Processes

6.6.1 Non-linearity of Knowledge Processes

The empirical findings in both case companies indicate, as depicted by the horizontal grey arrow in Figure 6.2, that knowledge is created, shared and retained throughout the integration of B2B e-commerce. For example, as the AutoCo case description has shown, knowledge creation occurred constantly during the innovation process. The knowledge process appears to be ongoing, as various activities and people were involved in knowledge creation at different times during the integration of B2B e-commerce. While knowledge creation during the strategy development involved senior managers and was facilitated by cross-organisational workshops, knowledge creation after AutoCo became dissatisfied with the pan-brand approach relied on in-house development and learning by doing involving users and projects members. On the whole, the findings imply that the

three knowledge processes are ongoing during the full duration of the IT-based innovation, rather than being confined to certain periods of time.

The findings strongly contradict the notion behind knowledge process frameworks, that knowledge processes appear in a linear fashion. For example, Pentland (1995) describes the interrelation between knowledge processes as "links in a chain" (p.4). Grover and Davenport (2001) depict knowledge processes in a figure as being linked through unilateral arrows. The figure shows a fixed order of knowledge being first generated, then codified and transferred, in order to be realised. The findings of this research suggest that there is no linear relation between knowledge processes. Instead, each of the three knowledge processes is ongoing and they occur simultaneously throughout the integration of B2B e-commerce.

6.6.2 Conjunction of Knowledge Processes

It has been argued here that the processes of knowledge creation, sharing and retention are ongoing and occur simultaneously. Yet, knowledge processes did not occur in isolation but in conjunction with each other at any given time during the integration of B2B e-commerce, as indicated by the vertical grey arrows in Figure 6.2. For example, knowledge processes strongly influenced each other during the strategy development at ComCo. By setting up a series of workshops that were facilitated by one IBM consultant, a specific context was constructed in which functional representatives were given the opportunity to create, share and retain knowledge, in order to develop a specific B2B e-commerce strategy for ComCo. Knowledge sharing through face-to-face conversations was interlinked with knowledge creation, as functional representatives developed a common understanding of how B2B e-commerce might affect ComCo. Simultaneously, knowledge was retained as part of the interaction between participants in this specific context.

The findings concerning the conjunction of knowledge processes highlight the importance of their mutual dependence, which have not been addressed sufficiently in previous research. Previous knowledge process frameworks treat knowledge processes as largely independent (e.g. Pentland, 1995; Alavi and Leidner, 2001). The findings suggest that it is important for a better understanding of knowledge processes, not only to focus on knowledge creation, sharing and retention individually, but also to appreciate their interdependence. The following section takes a close look at the conjunction of knowledge processes during the integration of B2B e-commerce.

6.7 Existence of Knowledge Phases

The first objective of this research was to investigate the nature and role of knowledge in IT-based innovations. Based on the interrelation of knowledge creation, sharing and retention identified in the previous section, the next step is to analyse how knowledge processes were interlinked throughout the integration of B2B e-commerce. In this section, the concept of knowledge phases is defined and their sequential relationship is outlined. The argument is made that the concept of knowledge phases provides an additional insight in our understanding of IT-based innovations.

6.7.1 Definition of Knowledge Phases

Looking at all three knowledge processes simultaneously, the case descriptions have also revealed that there were periods during which organisational activities for knowledge creation, sharing and retention remained largely unchanged. Such "knowledge phases", as they were called in the case descriptions, can thus be defined as periods of time during the IT-based innovation in which the relationship between all three knowledge processes are based on stable patterns of organisational activities. A stable pattern of organisational activities refers both to the combination of planned and emergent activities, and to the type of organisational activities at a given point during the IT-based innovation. For example, as the AutoCo case description showed, the conceptualisation phase saw all three

knowledge processes relying on planned activities and on organisational activities that were predominantly related to the series of cross-functional workshops. In comparison, the exploration phase at ComCo saw an emphasis on emergent activities and organisational activities initiated mainly by the community of practice. Although the length of knowledge phases varied, it can be noted that they lasted for considerable lengths of time, e.g. months, rather than weeks. At ComCo, the shortest phase was 7 months and the longest 15 months. At AutoCo, the shortest phase was 4 months and the longest 9 months.

Changes of knowledge phases were marked by organisational triggers that led to the change in the pattern of organisational activities. Such organisational triggers altered the "web of computing" that links artefacts, techniques, people and organisational resources, by challenging the legitimacy of the then current configuration (Kling and Scacchi, 1982). The change of the web of computing affected the way in which knowledge about B2B e-commerce was constructed, by altering underlying assumptions and expectations that determined the understanding of and interaction with the technology (Orlikowski and Gash, 1994). Practically, patterns of organisational activities were changed by the availability of resources and the establishment of interests. The availability of financial resources, e.g. funding for involving external consultancy, and human resources, e.g. creation of project teams, created the initial social context for the start of the project. The social context was also altered through the unavailability of organisational resources, e.g. budget rejection at ComCo. Equally, the establishment of interest, e.g. AutoCo's pursuit of an independent roll out or review by senior management at ComCo, changed the pattern of organisational activities. The notion of organisational triggers confirms existing innovation research, which identifies disruptive events (Schroeder et al., 1989) or dissatisfaction with performance (March and Simon, 1958) as a perceived cause for the change of an innovation trajectory.

In comparison to theoretical frameworks for the analysis of IT-based innovations, such as the decision episode framework by Clark et al. (1992), knowledge phases present a complementary concept for the understanding of IT-based innovations. While the concept of innovation episodes focuses on *what* kinds of implementation activities occur during the innovation process (e.g. agenda formation, selection, implementation and usage), the concept of knowledge phases highlights *how* such implementation activities are achieved in terms of knowledge processes. As shown in figure 4.8, which summarises the integration of B2B e-commerce at ComCo, the concept of innovation episodes highlights that during the time between the budget rejection and the managerial e-commerce review innovation episodes of selection (revision of e-commerce projects), implementation (IS infrastructure projects) and usage (two applications) occurred. The concept of knowledge phases details that these innovation episodes were based on similar processes of knowledge creation (e.g. mainly in-house development), sharing (e.g. through community of practice and social networks) and retention (e.g. through experts, social relationships and technology).

The primary definition criterion for innovation episodes is a similar type of implementation activity, for example, the "selection" includes all activities that are concerned with making a choice between different alternatives to be put forward for implementation (Clark et al., 1992). In contrast, the primary definition criterion for knowledge phases is the stable pattern of organisational activities that enable knowledge creation, sharing and retention in the context of IT-based innovations. A further difference is that whereas innovation episodes can be iterative and overlapping (Clark et al., 1992), the concept of knowledge phases views an IT-based innovation as a series of stable patterns of organisational activities. The notion of series of knowledge phases is outlined in more detail in the following section.

The existence of knowledge phases suggests that the integration of IT-based innovations is a highly discontinuous process. Stable patterns of organisational activities are disrupted by organisational triggers that require organisational members to change the way knowledge is created, shared and retained. Organisational triggers have the potential to alter the "web of computing" (Kling and Scachi, 1982), which also implies a change to the social system in which knowledge is distributed and embedded (Blackler, 1995; Tsoukas, 1996). It appears that there is a tendency for social systems to develop into a relatively stable configuration for a given purpose, e.g. to explore the capability of B2B e-commerce informally to match it with the organisational context better, which is reflected in the type of activities, e.g. reliance on emergent activities. Yet the availability of resources and the establishment of interests seem to have the potential to change these configurations. Consequently, IT-based innovations entail disruptive changes to knowledge creation, sharing and retention.

The notions of discontinuity and disruptive changes have not been sufficiently addressed in existing literature on knowledge processes and IT-based innovations that tend to depict processes as steady and continuous. For example, Nonaka and Takeuchi (1995) argue that there is "spiral of knowledge creation" suggesting that knowledge creation relies on an uninterrupted and smooth process that continuously develops. The same notion of continuity can be found in research on IT-based innovations. Although process research in IS implementation acknowledges that organisational activities during the IT-based innovation changes, e.g. from the evaluation to the implementation of applications (Cooper and Zmud, 1990; Myers, 1994a), such changes are depicted as moving from one activity to the other in a composed and linear fashion. This research makes a contribution by introducing the concept of knowledge phases that highlight the discontinuity in IT-based innovations regarding knowledge processes.

6.7.2 Series of Knowledge Phases at AutoCo and ComCo

So far, it has been argued that the innovation process consists of a series of knowledge phases that are separated by organisational triggers. The aim of this section is to define knowledge phases in more detail and to identify the relationship between them. A summary of the findings is depicted in Figure 6.3, which illustrates the type and sequence of knowledge phases for both case companies. The type of knowledge phase is derived from the purpose of knowledge processes during the IT-based innovation. As can be seen from Figure 6.3, the sequence of knowledge phases in both case companies show a great degree of similarity. The remainder of this section will describe the sequence and purpose of the knowledge phases in more detail.

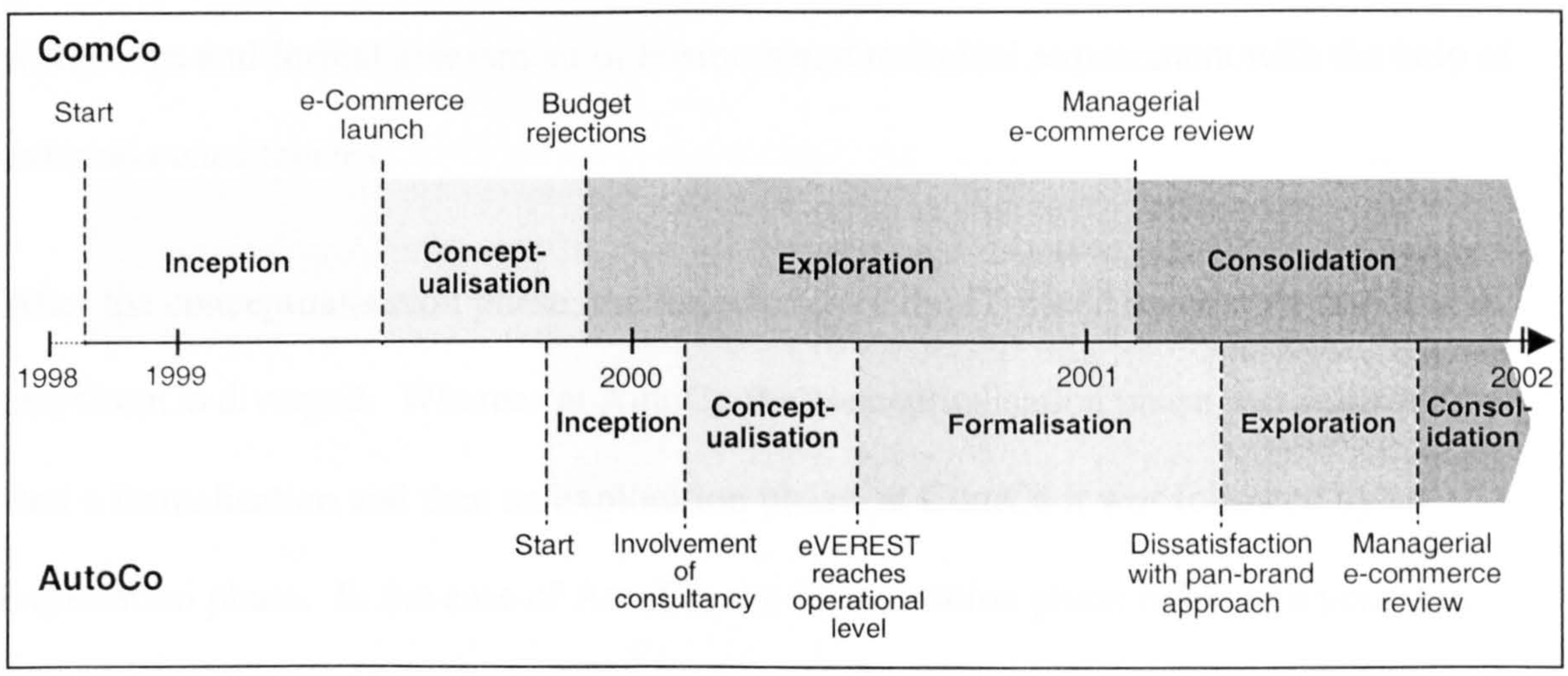


Figure 6.3: Knowledge Phases at ComCo and AutoCo

The inception phase refers to the period in which the purpose of knowledge processes was to support the initial contact of individuals in the organisation with the concept of B2B e-commerce, prior to the start of a formal initiative. Knowledge processes were emergent and based on the initiative of individuals who were personally interested in the topic of e-commerce. Whereas the IT-based innovation at ComCo was initiated bottom-up, with middle managers promoting the usefulness of e-commerce for the company, at AutoCo top management at CarCo US initiated a top-down approach. Despite these differences, organisational activities to manage knowledge were aimed at raising awareness about B2B

e-commerce and preparing the ground for the more planned activities in the following knowledge phase.

The inception was followed by a conceptualisation phase that refers to the period in which the purpose of knowledge processes for both companies was to draw on external and internal expertise, in order to develop an e-commerce strategy and identify appropriate applications for the company. Organisational activities to manage knowledge were aimed at building a conceptual understanding of issues related to e-commerce and developing an integrated approach across functions and, in the case of AutoCo, even across different companies within the same corporation. In the conceptualisation phase, knowledge processes were dominated by planned organisational activities, such as cross-functional workshops and formal assessment of business and technical requirement with the help of external consultancies.

After the conceptualisation phase, the trajectories of the IT-based innovation at AutoCo and ComCo diverged. Whereas at AutoCo the conceptualisation phase was followed by first a formalisation and then an exploration phase, at ComCo it was followed by an exploration phase. In the case of AutoCo, the formalisation phase refers to a period in which the purpose of knowledge processes was to support the formal launch and roll out of B2B e-commerce on an operational level. Organisational activities to manage knowledge were aimed at establishing formal organisational structures and processes, in order to facilitate pan-brand learning and sharing of knowledge between companies. Knowledge processes were dominated by planned activities, such as working in a pan-brand project team and rolling out the application to users.

The trajectory of the IT-based innovation at AutoCo and ComCo converged again when both companies entered an exploration phase. The exploration phase refers to a period in which the purpose of knowledge processes was to better match B2B e-commerce with the

organisational context. In the exploration phase, senior management withdrew formal control of the e-commerce initiative, in order to give project team members greater flexibility for experimentation. Whereas the withdrawal of management control at ComCo resulted from the rejection of the e-commerce budget, management at AutoCo tolerated that the project team rolled out OLQ more independently, due to the dissatisfaction with the pan-brand OLQ project work and the subsequent lack of progress. Without the managerial control, organisational activities to manage knowledge were aimed at exploring the applicability of the e-commerce application to the organisational context. While knowledge creation remained to be planned, knowledge sharing and retention were mainly emergent.

The following consolidation phase refers to a period in which the purpose of knowledge processes was to consolidate previous implementation activities and align them again with the original strategic e-commerce plans. At ComCo, senior management intervened and ordered the different functions to contribute to an e-commerce budget. At AutoCo, senior management ordered the users to adopt the e-commerce application, and organisational measures were put in place to control its uptake. Organisational activities to manage knowledge were aimed at aligning the innovation process again with the expectations senior management had, and demonstrating that senior management fully supported the implementation of B2B e-commerce applications. Knowledge processes tended to rely on planned activities such as formal meetings and workshops.

The empirical findings have shown that there was a great similarity in the types and sequence of knowledge phases at ComCo and AutoCo. The occurrence of similar types of knowledge phases might be related to the knowledge intensity of B2B e-commerce, as argued earlier. As B2B e-commerce is a complex IT-based innovation (Timmers, 1999), both companies needed to combine external and internal expertise during the conceptualisation phase, in order to develop a fundamental understanding of the IT-based

innovation on which the choice of applications was based. At AutoCo, the conceptualisation phase was followed by a formalisation phase in which the adoption of a formal project roll out sought to create, share and retain knowledge systematically among organisational members. Yet it failed to bridge the different bodies of professional and organisational knowledge, as is required in the context of B2B e-commerce (Turban et al., 1996). Due to the transformational characteristics of B2B e-commerce (Kalakota and Robinson, 2001), the exploration phase at both case companies was important, as it provided the space for learning about the application capabilities, as well as for disseminating the innovation on an informal level. In the consolidation phase, senior management ensured that B2B e-commerce was configured to existing technical and social systems in a way that reflected their own expectations about the particular needs of the adopting organisation (Clark and Staunton, 1989).

6.7.3 Usefulness of Knowledge Phases for the Understanding of IT-based Innovations

The concept of knowledge phases provides two major insights for our understanding of IT-based innovations. First, knowledge phases introduces a more detailed analysis of knowledge processes highlighting that they tend to occur in conjunction with each other, in order to serve a specific purpose in IT-based innovations. This research identified five different purposes: putting B2B e-commerce on the organisational agenda (inception phase), defining a business strategy (conceptualisation phase), operational implementation of B2B e-commerce (formalisation phase), informal matching of B2B e-commerce with organisational context (exploration phase), and realigning B2B e-commerce with initial strategy (consolidation phase). In order to achieve a specific purpose, knowledge processes are based on a stable pattern of organisational activities. It appears that certain patterns of organisational activities were used to serve specific purposes, ranging from more planned to more emergent approaches. The findings support the view that knowledge processes are inseparably linked to organisational practice (Brown and Duguid,

2001). Knowledge processes permeate activity and are highly pragmatic (Tsoukas, 1996). The findings strongly contradict the body of literature which abstracts knowledge from its purpose and treats it as an entity (Grover and Davenport, 2001).

Second, the concept of knowledge phases introduces the notion of time sequencing, in that there appears to be a specific sequence of knowledge phases in IT-based innovations. At both case companies, the sequence of knowledge phases started with the inception and moved to conceptualisation. At AutoCo this was followed by formalisation. Then, the sequence continued with exploration and finished with consolidation at both case companies. The existence of different knowledge phases indicates that there is a high degree of discontinuity in IT-based innovations which has not been depicted in other work, e.g. on knowledge creation (Nonaka and Takeuchi, 1995). Patterns of organisational activities change significantly to serve different purposes during the IT-based innovation. The findings contradict the implicitly held view by factor and process research in the field of IS implementation that the innovation process progresses smoothly and steadily in an linear fashion (Cooper and Zmud, 1990; Lucas et al., 1990). Instead, organisational activities achieve a degree of stability for periods of time, which can then be disrupted by organisational triggers, such as the availability of resources and the establishment of interests.

The concept of knowledge phases adds a new perspective to the understanding of IT-based innovations. The concept of knowledge phases portrays the IT-based innovation as a series of sequential phases that unfold over time. Each phase is characterised by a relatively stable pattern of organisational activities, on which the processes of knowledge creation, sharing and retention are based. The empirical findings of this research suggest that each knowledge phase served a different purpose in the integration of new knowledge, such as conceptualising the notion of B2B e-commerce, or exploring its capability to better match it to the organisational context. In order to overcome the fragmentation and simplicity of

IS implementation research (Kwon and Zmud, 1987; Galliers and Swan, 1999), Myers (1994b) calls for the creation of broad perspectives that provide an overarching framework within which IS implementation research can proceed. The concept of knowledge phases contributes to the field of IS implementation and IT-based innovation research, by using knowledge as an overarching concept to offer an analytical framework that focuses on the management of knowledge in IT-based innovations.

6.8 Management of Knowledge in IT-based Innovations

The second aim of this research was to investigate the management of knowledge in IT-based innovations. The final step is to analyse how knowledge was managed during the integration of B2B e-commerce at ComCo and AutoCo. In this section, attention is drawn to the fact that the management of knowledge were not explicit issues during the innovation process in both case companies. Then, the role of planned and emergent knowledge processes is discussed and suggestions are made for revising the conventional notion of control and drift in IT-based innovations. The section ends by outlining the role of power in the management of knowledge.

6.8.1 Absence of Knowledge Management Initiatives

The empirical findings in both companies showed that knowledge management was not an explicit issue for organisational members during the integration of B2B e-commerce. Besides some references to individual and organisational learning, none of the people interviewed or spoken to related the integration of B2B e-commerce explicitly to knowledge-related issues such as the creation or retention of knowledge. It was felt that knowledge is a too vague and abstract concept to be useful in getting the job of integrating new technology done. Instead, organisational members were interested in how to manage the integration of B2B e-commerce more effectively. Consequently, knowledge was not a conscious focus of any of the activities related to the integration of B2B e-commerce, but was nevertheless crucial for the innovation process as this research has shown. It appears

that there is a strong need to make the concept of knowledge more applicable to everyday activities, in order to generate value for practitioners.

Although knowledge was not an explicit issue in the integration of B2B e-commerce, it would be wrong to assume that knowledge was not managed in both organisations. Instead, knowledge was managed as an integral part of the planned and emergent activities during the IT-based innovation. For example, planned activities such as the organisation of cross-functional workshops for the specification of the technical and business requirements of B2B e-commerce applications at ComCo influenced the way knowledge was created and retained. Equally, emergent activities such as informal conversations at AutoCo affected knowledge sharing within the purchasing department. This seems to suggest that management of knowledge was inseparable from the organisational activities which organisations relied on to integrate new technology.

These findings support the argument that knowledge is embedded in activity (Blackler, 1995) and cannot be divorced from its purpose and context (Lave, 1993). Knowledge was managed as an integral part of the organisational activities to integrate B2B e-commerce, rather than being a separate category that was a focus of managerial activities. This questions the analytical value of the majority of knowledge management research, which divorces knowledge from the purpose and context, to portray it as an detached object for management (Davenport et al., 1998). The empirical findings suggest that the unit of analysis for understanding knowledge and its management are purposeful activities or processes (Blackler, 1995; Tsoukas, 1996; Brown and Duguid, 2001), rather than "knowledge" itself (Grover and Davenport, 2001). The processual nature of knowledge, in turn, justifies the choice of knowledge processes as a way of understanding how organisations manage knowledge in IT-based innovations.

6.8.2 Knowledge is Managed Through a Mix of Planned and Emergent Knowledge Processes

In section 2.4.2, it was outlined that knowledge processes can be both planned and emergent. This research provides two valuable insights regarding the notion of planned and emergent knowledge processes, as well as the interrelationship between them. First, while the findings support earlier research that emergent knowledge processes appear as part of the ongoing social interactions of organisational members (Nidumolu et al., 2001), they contradict the commonly held notion of planned knowledge processes as being a direct subject of managerial planning and control (Grover and Davenport, 2001). Planned knowledge processes during the integration of B2B e-commerce can be understood as managerial interventions or activities that directly or *indirectly* influenced the dynamics of knowledge creation, sharing and retention. For example, planned activities such as formal meetings and workshops strongly influenced knowledge sharing. Such gatherings provided a platform for sharing knowledge across functional or organisational boundaries. Likewise, the managerial demand for reports and project documentation enforced codification as a means of retaining knowledge during the integration of B2B e-commerce.

The research findings indicate that planned managerial interventions can create opportunities or a specific environment which facilitate the way knowledge is created, shared and retained. The findings support the importance of caring and nurturing social interaction for the management of knowledge (von Krogh, 1998; Nonaka and Konno, 1998). They also show that planned managerial activities cannot enforce knowledge processes. For example, the establishment of the pan-brand OLQ team provided an environment in which knowledge could have been created and shared. Yet, the findings showed that, due to the lack of cooperation, the pan-brand OLQ team was not used as an opportunity to create and share knowledge for the IT-based innovation. In comparison, the establishment of a cross-functional workshop during the conceptualisation phase at ComCo

was an effective means to create and share knowledge about the purpose and use of B2B e-commerce within the organisation.

The second valuable insight provided by the findings is regarding the interrelationship between planned and emergent knowledge processes. The case description showed that each knowledge process relied on planned and emergent activity at any given time during the integration of B2B e-commerce. The research findings in both case companies also suggest that knowledge processes depended more strongly on either planned or emergent activities. For example, while knowledge sharing at ComCo during the exploration phase relied more strongly on emergent activities such as interaction in the community of practice and social networks, it also relied at least to some degree on formal activities such as interaction in project teams.

The emphasis on planned or emergent knowledge processes appeared to be linked to knowledge phase. While knowledge phases with a strong involvement of management and reliance on formal project structure (e.g. conceptualisation, formalisation and consolidation) tended to rely on planned activities, knowledge phases with less management involvement and reliance on formal project structure (e.g. inception and exploration) showed greater reliance on emergent activities. This suggests that the reliance on planned or emergent knowledge processes tend to be encouraged by the degree of formality of the B2B e-commerce initiative.

The findings support existing research which argues that planned and emergent knowledge processes occur simultaneously (Alvesson and Kärreman, 2001). The findings add to our understanding of planned and emergent knowledge processes, in that they highlight their dynamic relationship. While strong management involvement and emphasis on formal project structure tended to encourage planned knowledge processes, it discouraged emergent knowledge processes and vice versa. For example, in the absence of managerial

interventions during the exploration phase at AutoCo knowledge sharing relied mainly on emergent activities such as boundary spanning and the use of social networks. At the same time, planned activities such as formal meetings and interaction among the pan-brand team members only played a minor role. The reliance on emergent and planned activities for knowledge sharing changed when senior management demanded a stronger emphasis on formal structures and procedures during the consolidation phase. While planned activities such as presentations and meetings became the main means for knowledge sharing, emergent activities became far less important.

6.8.3 Revising the Notion of Control and Drift

Whereas the concepts of planned and emergent activities refer specifically to knowledge processes, the concepts of control and drift refer more generally to the manageability of IT-based innovations. As depicted in Table 6.1, the findings of this research suggest that the conventional notion of control and drift, as discussed in section 2.4.3, has to be revised in three significant ways. The revisions are discussed in the remainder of this section.

	Conventional notion	Revised notion
Concept of control	The trajectory of an IT-based innovation is determined by a powerful social group of management, who orchestrate and exercise definitional and executive authority over other social groups within an organisation (Weil and Broadbent, 1998, Timmers, 1999).	The trajectory of an IT-based innovation can be influenced by a social group of management, who can create the environment that facilitates knowledge creation, sharing and retention of social groups (von Krogh, 1998).
Concept of drift	The trajectory of an IT-based innovation deviates from planned purposes and evolves, as social groups compete and improvise to react to turbulent and unpredictable circumstances (Orlikowski, 1996; Ciborra, 1999).	The trajectory of an IT-based innovation deviates from planned purposes and evolves as social groups improvise to react to turbulent and unpredictable circumstances. Such improvision is subject to normative control (Kunda, 1992; Alvesson, 1995).
Relationship between the concept of control and drift	Control and drift are contradicting concepts (Ciborra et al., 2000)	Control and drift are complementary concepts, being simultaneously active in influencing planned and emergent knowledge processes

Table 6.1: Comparison of Conventional and Revised Notions of Control and Drift

First, the empirical findings question the conventional notion of control in IT-based innovations that sees the innovation process as being determined by management, who

orchestrate and exercise definitional and executive authority over other social groups within the organisation (Weill and Broadbent, 1998). This notion is also commonly reflected in the literature on B2B e-commerce (Timmers, 1999). However, the earlier discussion has already shown that management can influence but not determine the trajectory of the IT-based innovation by creating opportunities or the context for knowledge processes to occur (von Krogh, 1998; Nonaka and Konno, 1998). Control was exercised through planned managerial interventions such as the establishment of a project structures and formal activities such presentations and meetings, as discussed in the analysis of knowledge processes.

Moreover, even managerial interventions showed an element of drift, as planned knowledge processes significantly involved organisational activities that were beyond managerial control. For example, knowledge sharing during the formalisation phase at AutoCo was based mainly on planned activities such as presentations and formal meetings. Meetings were planned to be highly structured and discuss specific issues. However, formal meetings tended to drift as buyers were keen to raise issues that were not on the agenda as they felt that management tried to downplay the problems associated with the use of OLQ. A further example is the conceptualisation phase at ComCo that relied mainly on planned activities, such as an official e-commerce project team and the development of an e-commerce strategy. However, organisational members used the flexibility in the development methodology such as agenda setting and the specification of technical and business requirements to establish their interests, thus introducing an element of drift to the initially intended development of the e-commerce strategy.

Second, the empirical findings also question the conventional notion of drift that depicts IT-based innovations as deviating and evolving from originally intended objectives because social groups compete and improvise to react to turbulent and unpredictable circumstances (Orlikowski, 1996; Ciborra et al., 2000). Both companies displayed a high

degree of drift in the inception and exploration phase. In the inception phase, both organisations gained awareness of B2B e-commerce and its potential use internally. All three knowledge processes were based to some degree on unplanned and even unintended activities that were part of the day-to-day activities of organisational members. For example, at ComCo there was no deliberate managerial effort to direct or guide implementation activities. Equally in the exploration phase, organisational activities to share and retain knowledge were emergent. As knowledge creation involved the use of scarce financial and human resources to buy software and organise projects, the organisation referred to planned organisational procedures such as formal selection of software vendors to achieve this task. Nevertheless, as a whole, the exploration phase saw a "hands-off" approach by senior management who withdrew formal authority and let the project team pursue the integration of B2B e-commerce as they saw fit.

Yet, knowledge phases of drift involved elements of control during the integration of B2B e-commerce. Alvesson and Kärreman (2001) argue that management have control over organisational members through behavioural intervention, e.g. directly affecting behaviour by supervision, and through normative interventions, e.g. indirectly affecting behaviour by targeting norms, emotions, beliefs and values. Normative control can be defined as the attempt to elicit and direct the required efforts of organisational members by underlying experience, thoughts, and feeling that guide their action (Etzioni, 1961; Kunda, 1992). For example, knowledge creation during the exploration phase at both ComCo and AutoCo was based on a high level of planned activities. Despite the absence of formal management intervention, knowledge creation was highly organised and targeted, reflecting the preferred approach of management. One explanation for this might be that emergent activities are influenced through organisational routines that have been adopted over time to deal with new technology (Feldman, 2000). These organisational routines implicitly held types of behaviour that have been endorsed by behavioural management

control and become organisational "ideologies" which indirectly guide the behaviour of organisational members (Alvesson, 1995). These findings extend our understanding of drift (Ciborra et al., 2000) and improvisation (Orlikowski, 1996; Ciborra, 1999), by highlighting the importance of normative control (Kunda, 1992).

Third, while existing research is divided on whether the trajectory of IT-based innovation is determined by either management as control or management as drift (Ciborra et al., 2000; Jones, 2001), the findings of this research suggest that forms of control and drift are simultaneously active in influencing planned and emergent knowledge processes. In terms of control, management had the capacity to influence planned knowledge processes directly by generating an environment that facilitated knowledge creation, sharing and retention (von Krogh, 1998; Nonaka and Konno, 1998). Management also influenced emergent knowledge processes through normative control, which guided the organisational members' action in the absence of direct managerial interventions (Kunda, 1992). In terms of drift, emergent knowledge processes occurred as organisational members improvised to react to turbulent and unpredictable circumstances (Ciborra, 1999). Still, even planned knowledge processes showed an element of drift as they provided the scope for organisational members to explore issues further than originally intended by management.

The findings contradict the current dualism between the notions of management as control and management as drift, which are depicted as opposing and exclusive (Orlikowski, 1996; Ciborra, 1999). The findings suggest that control and drift do not exist independently but appear in conjunction. Both control and drift can therefore be seen as productive complements, each playing a vital role in IT-based innovations.

6.8.4 Role of Power in the Management of Knowledge

In section 2.4.4, the role of power in the manageability of knowledge in IT-based innovations was outlined. The analysis of power in this section is limited in so far as it

concentrates on the implications for knowledge processes. Power was an important issue that helps understanding the dynamic of knowledge processes both on an interorganisational and intraorganisational level. On an interorganisational level, the integration of B2B e-commerce was used by both case companies as a vehicle to enact their independence from the parent company and from other brands. At AutoCo, OLQ was seen as an opportunity to demonstrate that AutoCo can adopt IT-based innovations better than other brands within CarCo. At ComCo, continuing with the B2B e-commerce projects despite the lack of corporate funding was an re-enactment of ComCo's long independence and the self-perception that it best knows about the needs of a manufacturing company. B2B e-commerce presented a potential danger to their independence in that similar software and hardware configurations, as well as common business processes would create common standards across brands. As a result, knowledge sharing between the case companies and other brands was limited, as each of the brands preferred to develop their own approach to the integration of B2B e-commerce. These findings confirm earlier findings that organisational groups stop sharing knowledge due to power struggles (Coombs et al., 1992). Organisational groups determine the scope of the organisational change, e.g. B2B e-commerce as an intraorganisational innovation rather than interorganisational innovation, to preserve their perceived interests, e.g. maintaining organisational independence (Knights and Murray, 1992).

Equally, on an interorganisational level, power played a role in the interaction between each case company and its supply chain members. At ComCo, B2B e-commerce applications affected both suppliers and dealers. However, neither suppliers nor dealers were involved in the development of the applications. Instead, they were presented with the final applications. Equally, AutoCo suppliers only learned about OLQ when they were invited to take part in an OLQ event. There was no prior communication about the B2B e-commerce initiative. As a result, there was no knowledge sharing about B2B e-commerce

between supply chain members. This is particularly surprising as one of the major benefits of B2B e-commerce is seen in streamlining and improving cooperation between companies in the same supply chain (Kalakota and Robinson, 2001). Instead it appears that B2B e-commerce reinforced the existing power system within the supply chain (Brown, 1998). Both ComCo and AutoCo considered themselves as being the focal point in the supply chain and occupying a dominant position.

On an intraorganisational level, the two case companies demonstrated different ways, in which formal authority was translated into power to influence the process of change (Hales, 1993). At AutoCo, there was a high degree of perceived legitimacy of management's authority. Formal hierarchical responsibilities within the purchasing department were, on the whole, respected and decision-making processes tended to be formal. In contrast, the integration of B2B e-commerce at ComCo showed a relatively low degree of perceived legitimacy of management's authority. This seems to be related to the absence of direct senior management support for the initiative, due to the rejection of the e-commerce budget. Consequently, the B2B e-commerce project team had to draw on alternative means, such as persuasion and influence, to win the support of different functions. The findings support earlier research which found that perceived legitimacy is an important issue in the integration of IT-based innovations (Hislop et al., 2000). It appears that, particularly in the absence of perceived legitimacy of management's authority, alternative social groups such as the community of practice at ComCo, can fill the void to implement their vision of B2B e-commerce.

These findings confirm that power pervades action in organisations (Walsham, 1993). For example, in both case companies the enactment of independence from the corporate parent and the demonstration of supremacy in the supply chain, inhibited joint knowledge creation, sharing and retention. Power was embedded in the relation between the organisations and related to the sovereignty of knowledge claims. Cooperation between

organisations was kept to a minimum and subject to preserving existing power relations (McLoughlin et al., 2000). This contradicts the view, as outlined in section 2.4.3, that B2B e-commerce forces supply chains members to cooperate more closely (Kalakota and Whinston, 1996). Equally, the exercise of power by management or other social communities, such as communities of practice, impacts on the dynamic of knowledge processes by favouring certain notions of B2B e-commerce over others. Whereas at AutoCo the vision was strongly created by management through perceived legitimacy, the community of practice at ComCo developed and promoted their own vision of B2B e-commerce. Further work is needed to explore these issues in more detail.

6.9 Summary

B2B e-commerce can be both an entrenching and altering IT-based innovation (Clark and Staunton, 1989; Swan and Clark, 1992). While in both case companies, B2B e-commerce was a complex and pervasive innovation, only at AutoCo was it also configurational and transformational. This contradicts the received view of B2B e-commerce inevitably causing radical organisational change (Timmers, 1999). Also, B2B e-commerce was found to be a knowledge-intensive IT-based innovation, because it required intense sensemaking (Weick, 1990), involved significant levels of knowledge creation (Scarbrough, 1995) and challenged existing knowledge systems (Blackler, 1995).

This research provided in-depth findings regarding the three processes of knowledge creation, sharing, and retention. The findings extend the concept of strategies for the creation of knowledge in IT-based innovations (Scarbrough, 1995). While Scarbrough (1995) suggests that organisations exclusively adopt one strategy for knowledge creation, the empirical findings suggest that organisations can change strategies during the integration of B2B e-commerce. The findings suggest that while the blackboxing strategy was important to gain a conceptual understanding of e-commerce issues and develop an e-commerce strategy, the prisoner strategy was necessary to match new knowledge in form

of technology and business processes to the organisational context. In addition, while the findings at AutoCo confirm that sensemaking congeals quickly after the initial introduction period (Tyre and Orlikowski, 1994), sensemaking about B2B e-commerce at ComCo was accompanied by high levels of unpredictability, due to the continuous introduction of new IT and its potential application (Weick, 1990).

Planned and emergent activities contributed in different ways to knowledge sharing. While planned activities supported the dissemination of ideas of B2B e-commerce to a great variety of organisational members, it did not necessarily facilitate intense knowledge sharing. In contrast, emergent activities enabled intensive knowledge sharing but were limited to a relatively small group of people. Mediators, such as a community of practice at ComCo and a boundary spanning individual at AutoCo, facilitated knowledge sharing across different social communities (Brown and Duguid, 1998; Tushman and Scanlan, 1982). However, they also demonstrated a potentially negative side in so far as they used knowledge sharing to promote their own notion of B2B e-commerce and excluded a large number of organisational members who were affected by the IT-based innovation. In both case companies, there was a lack of knowledge sharing across organisational boundaries that might be related to the locally embedded nature of knowledge (Brown and Duguid, 1998) and the existing power relations with external organisations (Knights and Murray, 1992).

The findings suggest that emergent activities resulted in knowledge retention that was exclusive to some organisational members. However, it appears that planned activities initiated by senior management were needed for knowledge retention in social systems, e.g. organisational structure, and scripts, e.g. operating procedures (Stein, 1995). Experts developed specialised knowledge as part of their professional expertise (Markus and Benjamin, 1996), as well as relational knowledge that would enable them to draw on the expertise of other experts rather than developing it themselves (Cross and Baird, 2000).

Organisational routines had both a facilitating and a restraining influence on the integration of B2B e-commerce. While organisational routines enabled the organisations to link knowledge about new IT with existing knowledge about technical and social systems through, for example, IS development methodologies, they made organisations less open to new ideas that would bring radical organisational change. These findings shed a more critical light on the discussion of organisational capabilities that tends to portray organisational routines as a source for superior performance rather than inhibiting organisational change (Grant, 1996a).

Although previous research acknowledges the interrelation between knowledge processes, they remain silent on what form this interrelation takes (Pentland, 1995; Alavi and Leidner, 2001). The research also provided two major insights into the relationship between the processes of knowledge creation, sharing, and retention. First, all three knowledge processes were ongoing and occurred simultaneously during the full duration of the IT-based innovation, rather than being more or less intense at certain periods of time. This finding strongly rejects the view of knowledge processes appearing in a linear fashion one after the other (Pentland, 1995; Grover and Davenport, 2001). Second, the three knowledge processes did not occur in isolation but in conjunction with each other at any given time during the integration of B2B e-commerce. While previous research treated knowledge processes as being largely independent (Pentland, 1995; Alavi and Leidner, 2001), the findings of this research highlight the mutual dependence of knowledge processes.

Building on the analysis of the three knowledge processes and their interrelation, the findings suggest the existence of "knowledge phases" - periods of time during the IT-based innovation in which the relationships between all three knowledge processes were based on a stable pattern of organisational activities. The concept of knowledge phases portrays an IT-based innovation as a series of sequential phases that unfold over time. Each phase is

characterised by a stable pattern of organisational activities on which the processes of knowledge creation, sharing, and retention are based. The empirical findings of this research suggest that each knowledge phase served a different purpose in the integration of new knowledge, such as conceptualising the notion of B2B e-commerce, or exploring its capability to match it better to the organisational context. The concept of knowledge phases contributes to the field of IS implementation and IT-based innovation research, by using knowledge as an overarching concept to offer an analytical framework that focuses on the management of knowledge in IT-based innovations.

The findings suggest that knowledge processes were managed through planned and emergent activities (Alvesson and Kärreman, 2001), which were part of the organisational activities to integrate new technology. While planned activities were important to create opportunities or a context in which knowledge creation, sharing, and retention could occur (von Krogh, 1998; Nonaka and Konno, 1998), emergent activities occurred as part of ongoing social interaction (Nidumolu et al. 2001). The findings also suggest that the conventional concept of control and drift has to be revised (Ciborra et al., 2000). While management cannot easily command or control the trajectory of the IT-based innovation (Scarbrough, 1998), improvisation can be subject to normative control (Kunda, 1992). This finding is surprising in that even improvisation is subject to control through other means. In addition, power was an important issue in that both case companies used B2B e-commerce to enact their independence from the corporate parent and demonstrate their supremacy in the supply chain, thus inhibiting joint knowledge creation, sharing and retention. This finding questions whether the major benefits of B2B e-commerce, which are associated with closer cooperation and integration (Timmers, 1999; Brynjolfsson and Kahin, 2000), can be achieved easily.

7. Conclusions

7.1 Introduction

The aim of this research was to develop, utilise and refine an analytical framework to understand how knowledge is managed as an integral part of organisational activities, where the specific purpose is to integrate IT-based innovations within an organisational context over time. This research has presented an analysis that was guided by an analytical framework developed here, of the ways in which knowledge processes (creation, sharing and retention) were managed during the integration of B2B e-commerce within two case companies. This section summarises the findings, contributions and limitations of this research and outlines implications for practice and future research.

7.2 Role and Nature of Knowledge in IT-based Innovations

The first research question was how the nature and role of knowledge can be conceptualised in IT-based innovations. This research developed an analytical framework for the understanding of the management of knowledge in IT-based innovation. In doing so, it revealed the existence of knowledge phases, highlighted the discontinuous nature of IT-based innovation, and discovered a potentially negative side to communities of practice and social networks for knowledge sharing.

7.2.1 Analytical Framework and Knowledge Phases

The research found that a socially constructed notion of technology and an interpretive view of knowledge are most appropriate for understanding knowledge-intensive IT-based innovations such as B2B e-commerce. Based on process research in the field of knowledge management and IS implementation, this research developed a processual framework, grounded in the literature, that guided and supported the empirical research. Incorporating findings on the integration of B2B e-commerce in two large OEMs in the

vehicle manufacturing sector, this research proposes an analytical framework, as depicted in Figure 7.1, for understanding the management of knowledge in IT-based innovations.

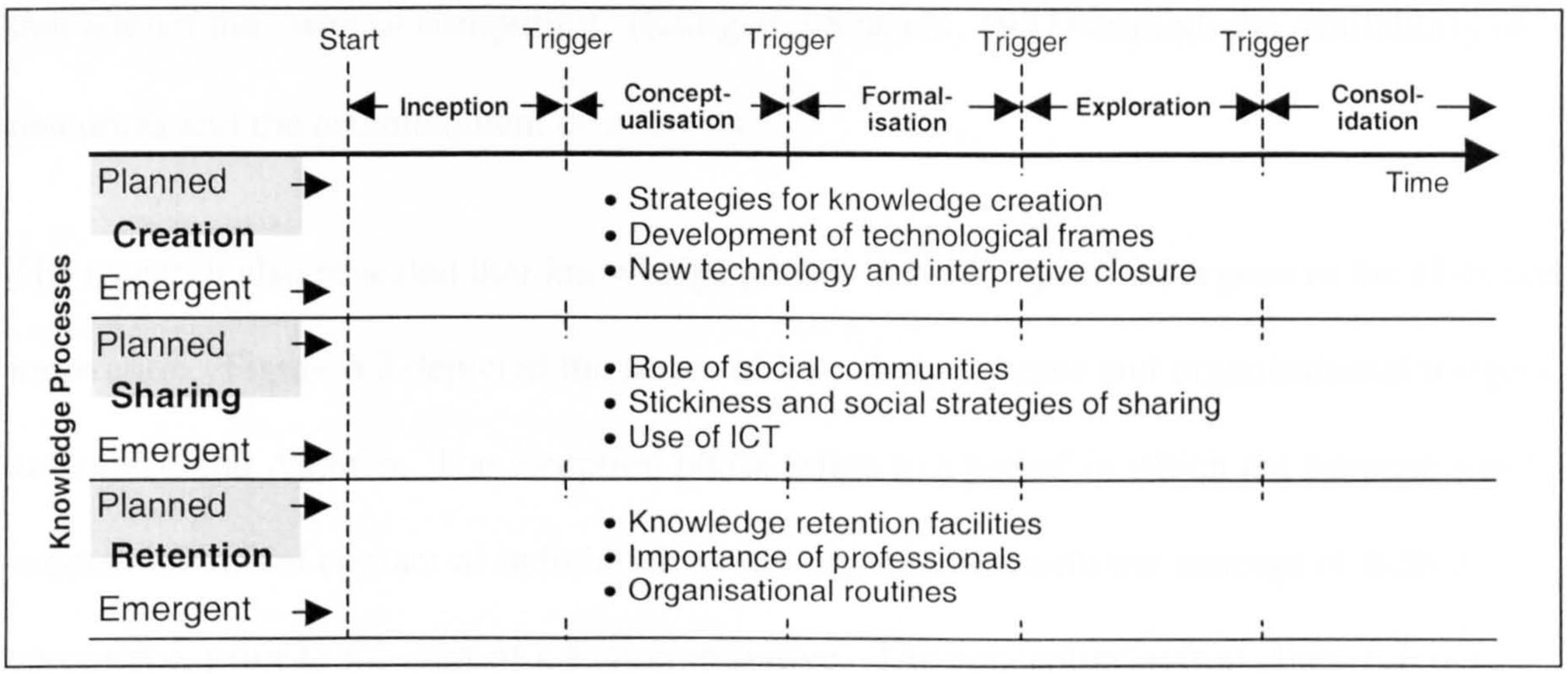


Figure 7.1: Framework for the Analysis of the Management of Knowledge in IT-based Innovations

The research revealed that the three ongoing and interrelated processes of knowledge creation, sharing and retention are key for understanding the management of knowledge in IT-based innovations. Each knowledge process is based both on planned and emergent activities, through which knowledge is managed. Planned activities refer to the generation of an organisational context, which facilitates and encourages the creation, sharing, and retention of knowledge (von Krogh, 1998; Nonaka and Konno, 1998). While managerial intervention can play an important role in creating such an organisational environment, it cannot force knowledge processes to happen. Emergent activities refer to ongoing social interactions through which organisational members create, share and retain knowledge (Nidumolu et al., 2001). Here, knowledge is beyond the active control of management, as knowledge processes occur as part of organisational members' day-to-day job.

Building on the analysis of the three knowledge processes and their interrelation, further findings suggest the existence of knowledge phases - periods of time during the IT-based innovation in which the relationships between all three knowledge processes are based on stable patterns of organisational activities. A stable pattern of organisational activities

refers to the combination of planned and emergent activities at a given point during the IT-based innovation. Changes in knowledge phases were marked by organisational triggers that altered the "web of computing" (Kling and Scacchi, 1982) through the availability of resources and the establishment of interests.

The research also revealed that knowledge phases served a specific purpose in the IT-based innovation. Figure 6.3 depicted the series of knowledge phases and organisational triggers at ComCo and AutoCo. The inception phase refers to a period in which the purpose was to support the initial contact of individuals in the organisation with the concept of B2B e-commerce, prior to the start of a formal initiative. The conceptualisation phase refers to a period in which the purpose was to draw on external and internal expertise in order to develop an e-commerce strategy and identify appropriate applications for the company. In the case of AutoCo, the formalisation phase refers to a period in which the purpose was to support the formal launch and roll out of B2B e-commerce on an operational level. The exploration phase refers to a period in which the purpose was better to match B2B e-commerce with the organisational context. The ensuing consolidation phase refers to a period in which the purpose was to consolidate the previous implementation activities and align them again with the initial strategic e-commerce plans.

The analytical framework and the concept of knowledge phases make a contribution to the literature by adding a new perspective based on knowledge processes from which to understand the integration of IT-based innovations. By using knowledge as the key perspective, an overarching framework was created which overcame some of the fragmentation in IS research (Kwon and Zmud, 1987; Galliers and Swan, 1999), and in which IS implementation research can proceed (Myers, 1994b).

7.2.2 Discontinuity of IT-based Innovations

The existence of knowledge phases suggests that the integration of IT-based innovations is highly discontinuous, in that stable patterns of organisational activities are disrupted by organisational triggers that require organisational members to change the way knowledge is created, shared and retained. For example, due to the inefficient way the pan-brand team worked together, management at AutoCo encouraged the OLQ project team to pursue a more independent approach for implementing OLQ. Activities for knowledge creation changed from being based on the cooperation in the pan-brand team to being based on in-house development and close collaboration with an external consultant. The reliance on formal presentations and meetings to share knowledge between the OLQ project team and buyers was largely replaced with informal networking. Activities for knowledge retention changed, in that members of the project team at AutoCo actively sought to become experts in the use of OLQ.

Existing literature fails to address the notion of discontinuity by depicting knowledge processes (e.g. Nonaka and Takeuchi, 1995) and implementation activities (e.g. Cooper and Zmud, 1990; Myers, 1994a) as occurring in a more or less composed and linear fashion. This research makes a contribution to theory and practice by introducing the notion of discontinuity in IT-based innovations regarding knowledge processes. Theoretically, it challenges the dominant idea of prolonged continuity and stability of organisational activities and emphasises the importance of disjunctures and disruptive changes. Practically, the research points out that there is not one best combination of knowledge processes to manage knowledge throughout the full length of the integration process. Instead, organisational activities for managing knowledge should reflect the organisational context at a given time during the IT-based innovation.

7.2.3 Limits of Community of Practice and Social Networks

The research findings revealed that, although a community of practice at AutoCo and social networks in both case companies were important for sharing knowledge among members during the integration of B2B e-commerce, they also showed two significant potential limitations. First, knowledge sharing in the community of practice and social communities was used to promote a specific construction of knowledge about B2B e-commerce. For example, project team members at AutoCo used their social networks to persuade users through informal conversations of the benefits of using OLQ for purchasing commodities. Thus, social networks can be understood as a means by which organisational groups holding different technological frames (Orlikowski and Gash, 1994) compete to establish their expectations and assumptions as the dominant notion of a new technology.

Second, knowledge sharing was limited to the members of the community of practice and social networks. For example, interviews and conversations at ComCo indicated that while knowledge was shared among the members of the community of practice and in their personal social networks within the organisation, it was not shared with other organisational members. It effectively excluded a large number of organisational members who were affected by the integration of B2B e-commerce. It appeared that the community of practice and social networks created significant boundaries for sharing knowledge by dividing organisational members either as "insiders" or "outsiders" when it came to knowledge sharing.

The potential limitations of communities of practice and social networks have not been sufficiently addressed in existing literature, which to focus only on their facilitating role in knowledge sharing (Hansen, 1999; Wenger and Snyder, 2000). Although some studies hinted at the potential limitations of communities of practice and social networks (Garud and Rappa, 1998; Brown and Duguid, 2001), they do not specify them in greater detail.

While communities of practice and social networks appear to facilitate knowledge sharing in incremental innovations (Orr, 1990; Hislop et al., 2000), they may inhibit knowledge sharing in more radical ones. The potential limitations could cause problems in radial innovations when the notion of new technology, promoted in communities of practice and social networks, is used, for example, to preserve and enhance interest and power status of a particular social group (Knights and Murray, 1992). In addition, as radical innovations tend to involve a variety of social groups, such as different organisational functions (Swan and Clark, 1992), the exclusion of organisational members could prohibit wider knowledge sharing. Further theoretical and empirical research is needed to explore these issues.

7.3 Management of Knowledge in IT-based Innovations

The second research question was how knowledge is being managed in IT-based innovations. The findings suggest that the management of knowledge needs to be part of a management strategy. The research also found that there is a need to revise the received notions of control and drift.

7.3.1 Management of Knowledge as Part of Organisational Activities

The research demonstrated that knowledge is a key dimension in the integration of IT-based innovations. Rather than being managed explicitly, as most of the literature on knowledge management would suggest, knowledge was managed implicitly as an integral part of organisational activities such as strategy development and roll out of B2B e-commerce applications. The management of knowledge was not part of managerial consideration in both case companies and organisational members failed to relate the issue of knowledge with the integration of B2B e-commerce. It appears that there is a strong need to make the issue of knowledge management more accessible to practitioners by linking it specifically to organisational activities.

This research questions the usefulness of the majority of research on knowledge management that seeks to detach knowledge from its context and activity so that it can be managed independently as part of a "knowledge management initiative" (e.g. Davenport et al., 1998; Alavi and Leidner, 2001). Instead, this research concludes that knowledge needs to be one element of managerial consideration besides, for example, project and change management, without separating it from its immediate purpose and context.

7.3.2 Revised Notions of Control and Drift

The findings contradict the conventional conceptualisation and dualism frequently found in the discussion of the manageability of IT-based innovations (Fitzgerald and Howcroft, 1998; Ciborra et al., 2000). Rather than seeing these dual conceptualisations as exclusive and diametrical (e.g. planned vs. emergent knowledge processes, and control vs. drift), they are mutually inclusive and strongly interlinked, as depicted in Figure 7.2. The remainder of this section outlines the interrelation in more detail.

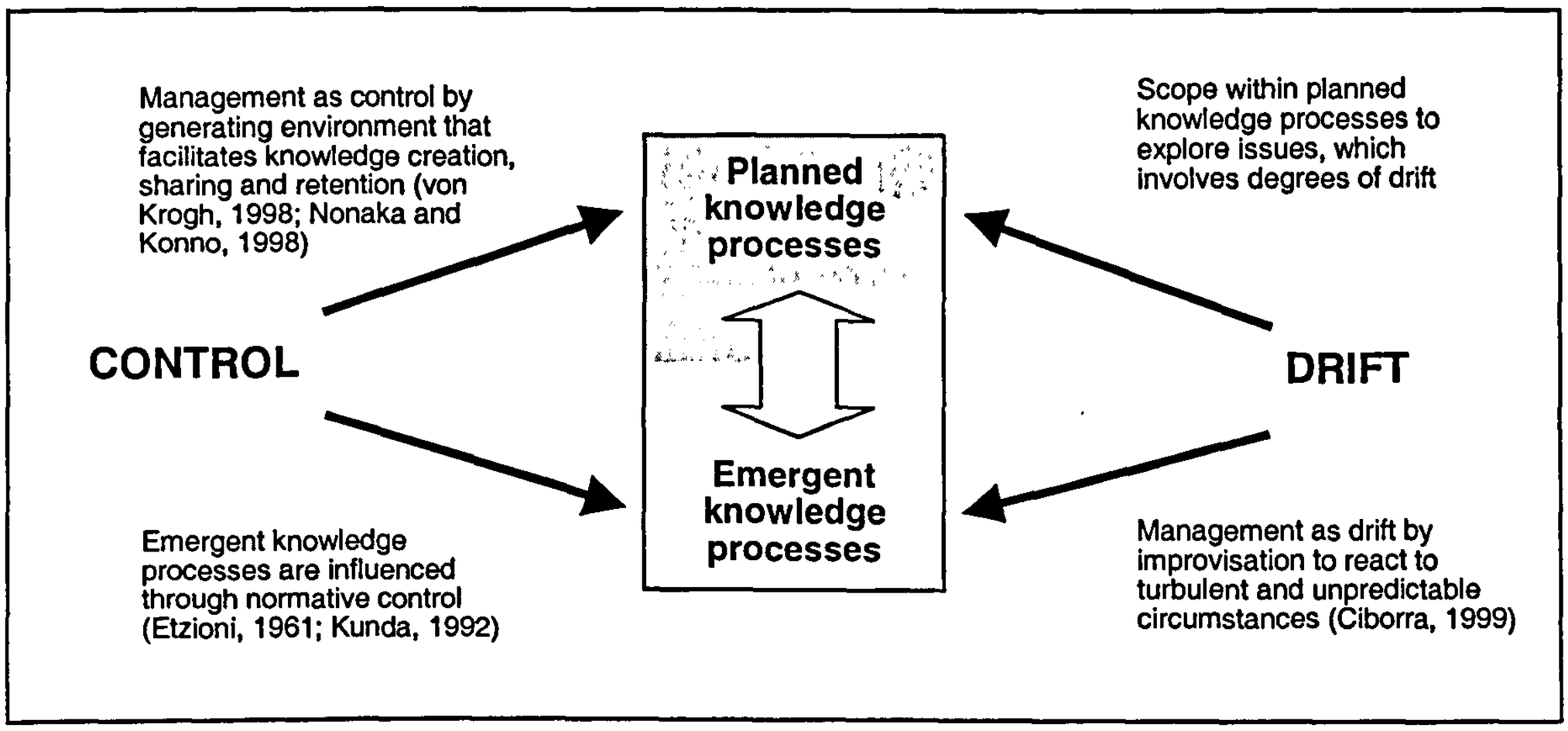


Figure 7.2: Interrelation of Control and Drift

The research revealed, as indicated by the vertical white arrow in Figure 7.2, that knowledge creation, sharing and retention relied on planned and emergent activities at any given time during the integration of B2B e-commerce. The findings also showed that knowledge processes relied more strongly either on planned or on emergent activities in

different knowledge phases. While knowledge phases with a strong involvement of management and reliance on formal project structure (e.g. conceptualisation, formalisation, and consolidation) tended to rely on planned activities, knowledge phases with less involvement of management and reliance on formal project structure (e.g. inception and exploration) showed greater reliance on emergent activities.

This research also found that control and drift simultaneously influenced planned and emergent knowledge processes. It has already been argued above that in terms of planned knowledge processes, management could create an environment that facilitated knowledge creation, sharing and retention (von Krogh, 1998; Nonaka and Konno, 1998). The findings also showed that managerial interventions could not enforce knowledge processes. For example, while planned knowledge processes were an effective means to create, share and retain knowledge during the cross-functional workshops at ComCo, they were ineffective in the case of the pan-brand OLQ project team at AutoCo. Furthermore, even planned knowledge processes showed a significant degree of drift. For example, planned activities such as formal meetings and IS development methodologies provided the scope for exploring and introducing issues that were originally not considered by management such as the impact of B2B e-commerce applications on the legacy systems at ComCo or the effect of OLQ on traditional supplier relationships. By considering such issues, formal meetings and IS development methodologies deviated from original plans and management intentions.

The findings also suggest that emergent knowledge processes occurred because social groups competed and improvised to react to unforeseen developments (Orlikowski, 1996; Ciborra, 1999). However, the research revealed that emergent knowledge processes were subject to normative control. Normative control is the attempt to elicit and direct the required efforts of organisational members by underlying experience, thoughts, and feelings that guide their action (Etzioni, 1961; Kunda, 1992). For example, knowledge

sharing during the exploration phase at ComCo and AutoCo was based on emergent activities such as informal conversations and meetings. Despite the absence of formal management intervention, knowledge sharing did not appear randomly but was highly organised and specific in so far as the organisational members sought to solve problems and make decisions about the roll out of B2B e-commerce. One explanation for this might be that emergent activities are influenced through organisational routines that have been adopted over time to deal with new technology. These organisational routines implicitly hold types of behaviour that have been endorsed by management and indirectly guide the behaviour of organisational members (Alvesson, 1995).

The research findings contradict the dualistic relation between the concepts of "management as control" and "management as drift" in IT-based innovations (Orlikowski, 1996; Ciborra et al., 2000). By showing the interrelation between two previously perceived contradictory concepts, this research contributes to the literature by conceptualising them as complements each playing a vital role in the management of knowledge in IT-based innovations.

7.4 Contributions of Research

Based on the objectives set out in the Introduction, this research makes a number of contributions. It reviewed literature in the area of knowledge management, IS implementation, IT-based innovation and organisational knowledge, in order to establish what is presently known about the management of knowledge in IT-based innovations. It became apparent that research in this area was both highly fragmented, e.g. lack of cross-disciplinary research, and tended to focus on specialised issues, e.g. organisational acquisition of technical knowledge (Scarbrough, 1995) or IS experts as knowledge holders (Currie and Glover, 1999). Yet there was a gap in the literature that would address the nature and role of knowledge and how it is managed in IT-based innovations. The contribution of this research is to pull together separate areas of existing research and

integrate them to create a coherent and analytical perspective on the management of knowledge in IT-based innovations.

An analytical framework grounded in the literature was developed and applied in the analysis of two case studies. The analytical framework has combined well-established analytical frameworks in the field of IT-based innovations (Clark et al., 1992) and knowledge management (Pentland, 1995; Alavi and Leidner, 2001). The strength of the analytical framework is the explicit focus on the management of knowledge in IT-based innovations. The analytical value of the framework is threefold. First, it is grounded in associated academic research, which allows the relation of the findings to existing studies. Second, by focusing on three processes of knowledge creation, sharing and retention, the analytical framework is open enough to analyse a wide variety of issues related to knowledge in IT-based innovations. Although this research highlighted a number of issues with regard to each of the three knowledge processes, the analytical framework can accommodate additional issues regarding knowledge creation, sharing, and retention. Third, while the framework supports a consistent analysis in different case studies, the individual character of each implementation process is retained.

This research adopted a constructivist view of IT (Bijker et al., 1987) and knowledge (Berger and Luckmann, 1967; Guba and Lincoln, 1994). Based on this view, an interpretive case study approach for the empirical investigation was adopted (Walsham, 1994). Previous researchers made the point that a positivist approach is unable to reflect the complexity and ambiguity required to investigate meaning systems (Daft and Wiginton, 1979; Benbasat et al., 1987; Orlikowski and Baroudi, 1991). Hence, conducting the research in the interpretive paradigm was the appropriate choice. As interpretive research is "not an excuse for sloppiness" (Walsham, 1995), this research followed a set of principles that helped conducting and evaluating the interpretive case study research (Walsham, 1995; Klein and Myers, 1999). By adopting an interpretive approach, the

research contributes to the diversity of research in the field of IS and innovation research which has long been dominated by the positivist tradition (Orlikowski and Iacono, 2001).

B2B e-commerce was chosen as an IT-based innovation, as it appeared to possess a number of innovation characteristics that made it particularly suitable for researching knowledge. Although there is a lack of empirical work on the integration of B2B e-commerce, conceptual work indicated that B2B e-commerce would possess a number of innovation characteristics, e.g. being transformational and pervasive, that made it particularly suitable for researching the management of knowledge (Turban et al., 2000; May, 2000). Two case companies, ComCo and AutoCo Cars, were selected as there they planned to conduct major B2B e-commerce initiatives. This research provides both a chronological description of events and a thematic description, guided by the analytical framework, of the integration of B2B e-commerce. By researching the integration of B2B e-commerce, this research contributes empirically by conducting research in an area which is dominated by anecdotal and speculative evidence, and theoretically by applying the analytical framework in two case companies.

In conducting this research, two major contributions to our understanding of the management of knowledge in IT-based innovation have been made. First, this research developed an analytical framework that focuses specifically on knowledge processes and how they are managed over the duration of an IT-based innovation. The analysis developed the concept of knowledge phases that presents a new insight into our understanding of IT-based innovations. Second, this research produced empirical evidence that rejects the dualistic notion of control and drift (Ciborra et al., 2000), as well as planned and emergent knowledge processes (Grover and Davenport, 2001). The contribution of this research is to show how they interrelate and concurrently contribute over the duration of IT-based innovations.

7.5 Limitations of Research

The contributions made by this research have also to be considered in the light of its limitations. As chapter 3 outlined in greater detail, researchers' subjectivity in interpretive research inevitably influences their interpretations of the phenomenon under investigation (Klein and Myers, 1999). Considerable effort has been expended to ensure that the empirical evidence reflects the phenomenon under investigation. For example, this research adhered to a set of principles that helped in conducting and evaluating interpretive case study research (Walsham, 1995; Klein and Myers, 1999), and presented sufficient evidence for the reader to assess credibility. Still, it cannot be fully ruled out that bias and preconceptions are inevitable factors that influence the researcher's work, at least to some degree. Although techniques were applied to avoid bias and preconceptions, it cannot be certain that another researcher using the same methodology would make exactly the same observations.

A further limitation for recognising the differences in interpretations about B2B e-commerce was the unavailability of certain organisational groups for interviews. In both companies, it was not possible to talk to top managers of the US parent companies. Their perspective would have provided a direct account of important events, e.g. the budget rejection for the B2B e-commerce initiative at ComCo and the inception phase at AutoCo. Whilst the researcher sought to compensate for this lack of perspective by talking to senior managers at ComCo and AutoCo, it needs to be assumed that their accounts of events were influenced by their personal interpretations and agendas. Also, as outlined in section 3.6.1, it was not possible to talk to some stakeholders at ComCo such as suppliers and dealers. Although the researcher sought to compensate for this by talking to suppliers and dealers of direct competitors to ComCo, their accounts are likely to reflect their specific experience with the competitors, and therefore have limited value for understanding ComCo's suppliers' and dealers' perspectives.

In addition, there are limitations in data collection for an abstract phenomenon such as knowledge. Gathering empirical evidence and distinguishing knowledge processes in a real life context is a challenge, as knowledge is intrinsic and embedded in activity as well as highly personal. Due to the strong interrelation of knowledge processes, the same activity could affect knowledge creation, sharing and retention. In addition, some interviewees had problems reflecting on the role of knowledge in their activity and expressing it verbally.

The conceptual developments proposed by this research have their grounding in two in-depth case studies. Walsham (1995) and Klein and Myers (1999) argue that interpretive research needs to be able to generalise from the case study in order to have explanatory value rather than just providing rich insights. This research abstracts and conceptualises from the empirical data by suggesting an analytical framework that helps in understanding how knowledge is managed in IT-based innovations. However, having only researched two case companies, the general applicability of these findings for other OEMs in the vehicle manufacturing sector or other sectors cannot be estimated. Further research is needed in this area, as discussed in the following section on the implications for future research.

As outlined in the section 3.5.4, the experience of implementing B2B e-commerce is likely to be specific to large OEMs in the vehicle manufacturing sector. Therefore, the applicability of the analytical framework for other types of settings such as SMEs, service organisations or non-OEMs in the manufacturing sector cannot be evaluated. It may well be the case, that in other types of settings, knowledge is managed differently which would have implications for the creation of an analytical framework. Further research is needed to apply the analytical framework in different organisational settings and discuss its usefulness.

7.6 Implications of Research

This research has implications for theory, method and practice. This section details the implications of this research for these three aspects and how they could be developed.

7.6.1 Theoretical Implications

The research contributed to the body of theoretical knowledge by developing an analytical framework to understand how knowledge is managed in IT-based innovations over time and by revising the received notion of management as control and management as drift. The analytical framework and the revised notion of control and drift both need further development as well as have more general implications for research into IS implementation and knowledge management.

Regarding the analytical framework, this research identified three key processes of knowledge creation, sharing, and retention. Further research is needed to establish whether these three knowledge processes provide an extensive framework to analyse knowledge in IT-based innovations. It might be the case that there are additional knowledge processes or that the three knowledge processes can be subdivided into more specific processes. Such findings would provide a more detailed analytical framework for our understanding of knowledge processes in IT-based innovations. Also, this research focused on specific aspects regarding the three knowledge processes. Yet such aspects might not be extensive enough to describe each knowledge process in full. Further research is needed to explore each knowledge process in more detail. This could be done through both theoretical and empirical work.

This research argued that IT-based innovations can be conceptualised as a series of knowledge phases which were defined as periods of time during the IT-based innovation in which the relationships between all three knowledge processes are based on stable patterns of organisational activities. Further research is warranted into whether knowledge phases

are a general phenomenon in IT-based innovations or specific to B2B e-commerce. In addition, further research needs to explore whether the type and sequence of knowledge phases, e.g. inception, conceptualisation, formalisation, exploration and consolidation, can be found in other IT-based innovations. This calls for further empirical research of the integration of B2B e-commerce and other complex IT-based innovations such as the integration of ERP or BPR.

Besides the further development of the analytical framework, the research identified significant issues regarding the management of knowledge in IT-based innovations. First, the existence of knowledge phases indicates that the innovation and knowledge processes are highly discontinuous rather than being stable and ongoing. The implication for future work in the field of knowledge management is to take greater account of disruptions and change to knowledge processes. Conceptually, this means to move away from a linear, often simplistic view of innovation and knowledge processes and emphasise their context and time specific characteristics. Empirically, further research needs to investigate how and why the characteristics of innovation and knowledge processes change over time.

Second, it has been demonstrated in this research that knowledge processes can provide a useful framework to understand the management of knowledge in organisations. The focus on knowledge processes presents an alternative approach to conceptualise the management of knowledge compared to the more common models based on the differentiation between tacit and explicit knowledge. It has been argued in section 2.2.2 that the notion of tacit and explicit knowledge is not unproblematic and is conceptually anchored in a positivistic notion of knowledge. The diversity of knowledge management research would benefit from adopting new perspectives, e.g. knowledge processes, instead of repeating conventional perspectives such as the interaction between tacit and explicit knowledge.

Third, the research showed that knowledge is managed as part of organisational activities, such as the integration of B2B e-commerce. Despite the emphasis on ICT in current literature on knowledge management, this research revealed that the management of knowledge involves mainly social activities based on face-to-face interaction. This has two implications for future research into knowledge management. For one, research needs to focus more strongly on purposeful activities, e.g. innovations, rather than knowledge management projects that detach knowledge from its immediate context and purpose. In addition, the usefulness of ICT for knowledge management needs to be critically discussed. This research indicated that people do not use ICT naturally to manage knowledge in IT-based innovations. Further investigations need to answer the fundamental question of to what degree, if at all, ICT can facilitate the management of knowledge.

Regarding the revised notion of control and drift, this research rejected the conventional dualistic notion of planned and emergent knowledge processes, as well as management as control and management as drift. Instead, this research emphasised their interrelation during the integration of B2B e-commerce. Further research is needed to focus on the changing dynamic of control and drift on planned and emergent knowledge processes over time in IT-based innovations. Conceptually, work is needed to integrate the notions of control and drift and to establish a common theoretical underpinning. This could be done by showing the historical development of both notions in the management literature and by arguing that each notion provides a valuable, non-contradictory perspective rather than two distinctive paradigms.

Empirically, further research is needed that would focus specifically on the interrelation of control and drift during IT-based innovations. In particular, the issue of normative control that appeared to influence emergent knowledge processes needs to be investigated to answer the questions from where normative control originates and to what degree it is at the disposal of management. Also, the scope within planned knowledge processes to let

the IT-based innovation drift and deviate from original organisational aims needs to be explored more fully. The question here is whether drift is actually intended by management and whether organisational members deliberately create the scope to accommodate their goals. Such empirical work could be conducted as part of the refinement of the analytical framework.

7.6.2 Methodological Implications

The use of an interpretive case study methodology to investigate the management of knowledge in two case companies has two implications for further research. First, interpretive case study methodology is still not widely accepted as a rigorous methodology to investigate phenomena in the field of IS research. Although this research attempted to introduce rigor by outlining the principles for evaluating interpretive case studies, further seminal work is needed to provide guidance in planning and executing empirical work in an interpretive tradition. Furthermore, such seminal work needs to address the issue of data analysis in far greater detail than existing work in order to provide guidelines and practical tools for interpreting empirical data.

On the more practical side of interpretive research into the management of knowledge in IT-based innovation, this research showed that it is important to speak to a wide variety of organisational members over time to access their assumptions and expectations of the innovation process. In order to avoid later problems with data collection, future research would benefit from securing access early on to the whole organisation, e.g. people on different hierarchical levels and in different functions. In the case of interorganisational innovations such as B2B e-commerce, social groups outside the organisation such as suppliers, consultants, and other organisations within the corporations need to be involved.

The empirical research at ComCo and AutoCo indicated that, although there is a significant value in managing knowledge, practitioners showed little awareness and failed to

appreciate the relationship between their activities and the way knowledge was created, shared and retained. While an interpretive methodology was helpful for the initial development of the analytical framework, other methodologies, which would allow the framework to be used in a more applied way, might be appropriate for its further refinement.

One such methodology could be action research (Wood-Harper, 1985; Lau, 1997). Baskerville and Wood-Harper (1996) outline three distinct characteristics of action research, which make it particularly suitable for the next stage of this research. First, action researchers are actively involved with their study subjects. This allows the close examination of organisational activities and of how they influence knowledge creation, sharing and retention. Second, action researchers expect to generate knowledge, which will further enhance the development of models and theories with the aim of understanding the complex human process, rather than prescribing some universal truth. Consequently, action research appears to be well suited to refining the analytical framework developed by this research. Third, action research merges research and praxis, thus producing practically relevant research findings. This characteristic is particularly important for making the issue of knowledge management more accessible to practitioners and, therefore, actionable.

Despite some differences, such as the involvement of the researcher with the study subjects, the analytical framework developed here and action research are complementary in that they are both grounded in an interpretive philosophical framework (Susman and Evered, 1978). Baskerville and Wood-Harper (1998) point out that there are various forms of action research methods. One appropriate form for the further refinement and application of the analytical framework developed here could be "process consultation" (Schein, 1969). This is aimed at organisational development by transferring skills to organisational members in order to enable them to accomplish continued self-helping

problem-solving. In the context of the next step of this research, this would mean to develop, with organisational members, practical approaches to manage knowledge processes (creation, sharing and retention) during the integration of IT-based innovations. As Baskerville and Wood-Harper (1998) emphasise, the value of process consultation includes increasing attention to human processes over organisational structure, to long-term effectiveness over short-run output, and to perpetual diagnosis over generalisation and principles. Such foci have been largely missing from existing knowledge management research.

7.6.3 Practical Implications

Besides contributing to academic work, this research also produced findings of practical value. This section makes a number of suggestions regarding the management of knowledge during the integration of IT-based innovations such as B2B e-commerce. As argued above there is a need to make the concept of knowledge management more applicable to everyday activities in order to generate value for practitioners.

This research showed that knowledge is inseparably linked to organisational activities to integrate IT-based innovations, and is managed as an integral part of, for example, project management and IS development. Hence, regarding the issue of management, it appears to be important not to detach knowledge from its immediate organisational tasks. While knowledge should be a key dimension of managerial attention, there might be a risk in setting up a stand-alone knowledge management initiative that seeks to detach knowledge from its purposeful activity and specific organisational context.

This research revealed that the management of knowledge is based on three key processes of knowledge creation, sharing and retention. Each knowledge process is based on planned and emergent activities, which need to work together, in order to support the integration of IT-based innovations. In terms of planned activities, management needs to

be understood as generating opportunities and an atmosphere, in which knowledge can be created, shared and retained. In terms of emergent activities, it needs to be accepted that knowledge is beyond the control of management, as organisational members create, share and retain knowledge as part of their ongoing social interactions and improvisations, in order to perform their jobs.

The research showed that knowledge creation is both based on cooperation with consultancies and on in-house development. Crucial for knowledge creation with consultancies are good personal relations between organisational members and consultants. Consequently, the "chemistry" between individuals might be a significant factor in the selection of a consultancy. Knowledge creation through in-house development is facilitated by the expertise and personal initiative of team members. This implies that organisational members need to be selected who, besides their specific expertise, display a high degree of motivation and cooperation for the project.

The research revealed that IT-based innovations such as B2B e-commerce affect different stakeholders inside and outside the organisation such as different departments and suppliers. Whereas planned activities such as presentations and formal meetings appear to be necessary to inform a wide range of people about the status of the innovation process, emergent activities such as informal conversations and networking are useful for sharing knowledge. However, management needs to be aware that members of communities of practice and social networks only promote their perspective and exclude other employees from knowledge sharing, which might have a negative effect on the innovation process.

Collective knowledge retention is difficult to achieve. The research indicated that knowledge about IT-based innovations tends to be retained by individuals or small groups. This makes the organisation highly dependant on experts who, if they decided to leave, could take the knowledge about the IT-based innovation away. It appears therefore to be

important to embed knowledge about IT-based innovations in collective knowledge retention facilities, such as organisational structures and business processes. One major obstacle likely to arise from existing organisational routines such as IS development methodologies, which limit the extent to which new knowledge can be retained. It needs to be evaluated whether the organisation has to "unlearn" its current practices and processes to embrace new configurational technology.

The research revealed that there were phases, which relied more strongly on planned or emergent knowledge processes in order to serve a specific purpose in the integration of IT-based innovation. In the case of B2B e-commerce, phases with a strong reliance on planned knowledge processes were used to define a B2B e-commerce strategy, roll out applications to users and, after some time, realign the implementation effort with the initial strategy. Phases with a strong reliance on emergent knowledge processes were important to let organisational members match new applications with the specific context of the organisation. Consequently, the level of interventions to manage knowledge may have to vary according to the phase the IT-based innovation is in.

8. References

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9. Appendices

Appendix A - Interviews ComCo[1]

Name	Role	# Interview	Length
People with direct project involvement			
Robert Miles	E-business Programme Manager	2	180min
Eric Taylor	Manager, Systems	2	270min
John Payne	Project Manager – Systems	2	210min
Will Robinson	Manager, Systems	2	195min
Different functions			
Gary Harrison	Manager Finance Ltd	1	60min
Martin Evans	Manager Marketing Communications	3	270min
Jim Blake	Head of Information Systems	1	90min
Oliver Allen	Manager Purchasing	1	60min
Sister organisation			
Peter Köhler	Manager Dealer Development, SisterCo	2	105min
Dealers			
Paul Murphy	Smith, Financial Director, Competitor 2 dealer	1	70min
Competitors			
Nigel Green	E-business Managers, Dealer Network, Competitor 1	1	70min
Stephane Laurant	Vice President, Dealer and Business Opportunity Development, Competitor 1	1	150min
Chris Phillips	E-business Manager, Dealer Network, Competitor 2	1	60min

[1] Names of interviewees are changed to protect their anonymity

Appendix B - Interviews AutoCo[2]

Name	Role	# Interview	Length
People with direct project involvement			
Paul Turner	OLQ Co-ordinator	4	320min
Peter Watson	OLQ Project Manager	2	160min
John Miller	OLQ Co-ordinatior	1	120min
People involved in the eVEREST initiative			
Alan Spencer	eVEREST Project Manager	1	65min
Steve Russell	eVEREST Project Manager	1	80min
Nick Parker	MIS Managers, Purchasing Department	1	80min
Jim Lawrence	Manager of Legacy Systems	1	80min
Users of B2B e-commerce application			
David Jackson	Buyer, Core Production Purchasing	1	100min
John Howard	Buyer, Non Production Purchasing	1	80min
Pan-brand team members			
Chris Hall	ORQ Project Co-ordinator, CarCo UK	1	70min
Maria Wilson	OLQ Co-ordinator, CarCo UK	1	N/A
Harry Gibbs	OLQ Co-ordinator, Brand I	1	70min
Lars Thomasson	OLQ Co-ordinator, Brand II	1	75min
Helga Brockmann	OLQ Co-ordinator, CarCo Germany	1	60min
CarXchange and reverse auction providers			
Jim Scott	Auction Engineer, CarXchange	1	60min
Aline Hoffmann	Marketing Manager, CarXchange	1	60min
Carola Köller	Supply Network Manager, Marketplace 1	1	30min
Will Lee	Auction Engineer, Marketplace 2	1	90min
Suppliers			
Kathy Cook	Sales Manager, Supplier 1	1	30min
Lynda Green	Sales Director, Supplier 2	1	30min
Competitors			
Jutta Müller	OLQ Director, Competitor 1	1	110min
Michael Reinhardt	Corporate e-Business Director, Competitor 2	1	80min

[2] Names of interviewees are changed to protect their anonymity

Appendix C - Interview template

Area of interest	Question
Personal background	
Employment history and qualification	- Could you give me some background information about you and your role outside the involvement in the e-commerce project?
Project details	
Project definition	- What is the B2B e-commerce project about?
Stakeholders	- Which departments were involved in the project?
Role in project	- What was your role in the project?
Knowledge creation	
Strategies for knowledge creation	- Where did the expertise come from to develop the B2B e-commerce application?
Technological frames	- How do you rate the functionality of the application? - What was the main reason for the organisation to implement the technology? - How is the application used on a daily basis?
New technology and interpretive closure	- Was it a smooth process to implement the application?
Knowledge sharing	
Role of social communities	- How did you share knowledge relevant to the B2B e-commerce application?
Stickiness and social strategies	- Where there any problems in talking to people?
Use of information and communication technologies	- How important was electronic communication for talking to other people during the duration of the B2B e-commerce project?
Knowledge storage	
Knowledge retention facilities	- How do you keep the lessons learned? - In which way has the organisation changed due to the use of the application?
Importance of professionals in IT-based innovations	- Are there any experts who know a great deal about B2B e-commerce?
Organisational routines	- Have the B2B e-commerce applications changed business processes or the way you implement new technology?

Evaluation

Indicators of success and failure	- Do you think it has been a successful project? What are the indicators for that?
Context of the integration	- Where do you see the strengths and weaknesses of the implementation process?
Power and politics	- Were there any political issues that impacted on the implementation of B2B e-commerce?

Personal information

Knowledge sources	- How do you make sure that you stay up to date with the latest developments?
Networks	- With whom do you talk about e-commerce (internally, externally)?
Notion of e-commerce	- Do you think that e-commerce is any different from other technologies you have come across?